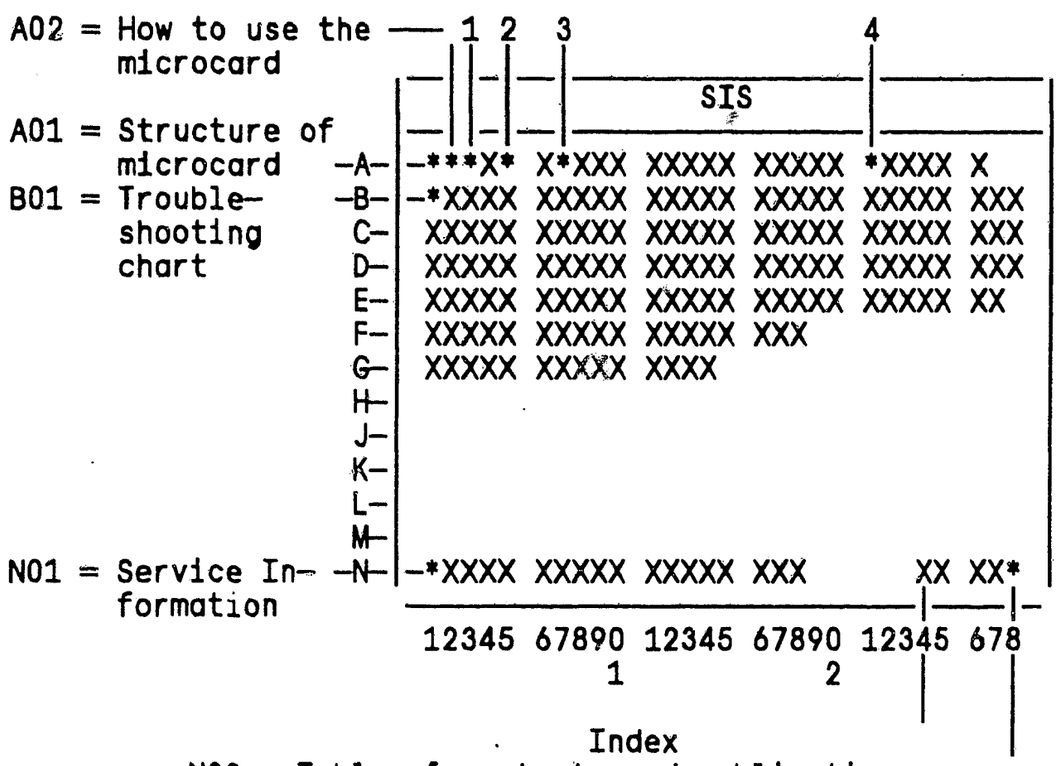
STRUCTURE OF THE MICROCARD (BASIC INSTRUCTIONS)



N28 = Table of contents and publication information

1 = Special features
2 = Safety and precautionary measures
3 = Test equipment and tools
4 = Installation position of components

a. Read from left to right.

b. Title of micropicture (appears on each coordinate).

E16	Product/component/test step	

Coordinate

c. Limits of section

⟹	⟺	⟸	⇒ ⇐
Beginning	Mid-section	End	One-page section

HOW TO USE THE MICROCARD

Trouble-shooting instructions for

System: ABS 2 B

Descriptions, photos, terminal assignments and special features refer to the vehicle:

BMW 325 iX (all-wheel drive), 11.1985 ->

These basic instructions are detailed trouble-shooting instructions. They must not be used as vehicle-specific instructions.
Attention! Descriptions and photos may differ from those in the vehicle-specific brief instructions.

Binding set values, terminal assignments and special features must be taken only from the vehicle-specific brief instructions.
For brief instructions, see the table-of-contents microcard KFZ-00..

SPECIAL FEATURES

* ABS with 4 wheel-speed sensors and 3 hydraulic channels.
* Acceleration sensor (a_L)
* Signal from clutch switch
* Idle speed increase

SAFETY AND PRECAUTIONARY MEASURES

ABS is basically maintenance-free, however, when working on vehicles with an ABS system, the following must be observed:

1. Whenever welding with electric welding equipment, disconnect plug from the electronic controller.
2. Whenever painting the vehicle, the electronic controller may be loaded for a short time to a max. of + 95° C, and for a long time (approx. 2 hours) to a max. + 85° C.
3. After exchange of the hydraulic modulator, the controller, wheel-speed sensor, and of the wiring harness, as well as after work procedures in which contact is made with the ABS assemblies (e.g. accident repair), the complete ABS system must be checked using the tester.
   Make sure that the brake lines, wheel-speed-sensor connections on the controller, and the wheel-speed-sensor plug connections are assigned correctly (see vehicle-specific terminal diagram).
4. After any work is carried out on the brake system, this system must be bled and a high-pressure test conducted.
   All junctions must be tested for leakages.
5. Be sure to properly tighten the battery-cable terminals on the terminal posts of the battery.
6. Do not use a fast charger for starting the engine.
7. Never disconnect the battery from the vehicle electrical system while the engine is running.

8. Disconnect the battery from the vehicle electrical system before fast charging.

9. Make sure that all connectors of the wiring harness are seated properly.

10. Never disconnect or connect the ABS wiring-harness plug of the controller when the ignition is switched on.

11. For safety reasons, the hydraulic modulator must never be repaired, but be exchanged only as a complete unit.

    Excepted from this are the motor relay and the valve relay.
    Both relays may be exchanged.
    Apart from the brake-line connections, no screws at the hydraulic modulator may be loosened.
    Once they are loosened, it is impossible to make the brake circuits leak-free ever again!

D a n g e r o f f a t a l a c c i d e n t !

Caution when handling brake fluid!

a) Pour brake fluid only into containers from which it would be impossible to mistakenly consume the fluid internally.

   (D a n g e r ! P o i s o n !)

b) Even the slightest trace of mineral oil leads to failure of the brake system. Special care must be taken with colorless or yellow-tinted brake fluid, since the danger of a mix-up is greatest with such fluid. If mineral oil is found in the brake system or there is a suspicion of mineral oil being in the brake system, the complete brake system must be thoroughly flushed out with brake fluid. In addition to this, the master cylinder must be replaced.

c) Do not allow brake fluid to come into contact with the paintwork of the vehicle, since the fluid attacks the paint.

d) Brake fluid is exceedingly hygroscopic; i. e. it absorbs moisture from the air, thus reducing its boiling point. For this reason, brake fluid must be stored only in well-sealed storage containers.

N o t e :

As the operation time progresses, the boiling point of the brake fluid drops owing to the brake fluid permanently absorbing moisture from the atmosphere. If the brakes are subjected to very severe loading, this can, therefore, lead to vapor-bubble formation in the brake system.

Therefore, the brake fluid must be replaced on an annual basis, preferably in spring.

Brake test for all-wheel-driven vehicles:

Do not test for longer than 60 seconds on a single-axle brake dynamometer.

20 seconds for the front axle, rear axle, and hand brake respectively.

Since the viscous locks must cool down, the brake test may be repeated only after waiting for 30 minutes.

Caution! If this cooling-off period is not observed, there is a danger of the viscous coupling breaking down totally.

Do not switch to individual-wheel mode.
Observe the specifications of the vehicle manufacturer.
Use the operating instructions.

Power-output test for all-wheel-driven vehicles:

Do not test on the single-axle vehicle-performance tester.

If this regulation is not observed, the differential breaks down totally. Danger of accident.

TEST EQUIPMENT AND TOOLS

Description	Designation	Part number
ABS 2 LED tester	KDAS 0003	Order from: Robert Bosch GmbH KH/VKD 3 Postfach 41 09 60 D-7500 Karlsruhe 41
Adapter lead (included in scope of delivery of tester)	KDAS 0003/2	
Feeler gauge for acceleration sensor		BMW Part No. 34 5 150 3)
Charging and bleeding device		e.g. ATE Part. No. 3.9302-1000.4 1)
Bleeder fitting for connection of charging and bleeding device on the fluid reservoir of the brake master cylinder		ATE Part No. 3.9302.0702.2 1)
Bleeder hose		ATE Part No. 3.3590.2300.1 1)
Auxiliary hose		ATE Part No. 3.9302.0704.2 1)
Brake-pedal-actuating device		ATE Part No. 3.9312.0100.4 1)

1) = To be obtained from: Alfred Teves GmbH, Guerickestr. 7 D-6000 Frankfurt (Main)

3) = To be obtained from: Cartool Alfred-Brehm-Str.5 D-8070 Ingolstadt/Donau

Test equipment and tools (continued)

Designation	Code	Part number
Pressure tester Tester for checking low-pressure and high-pressure at hydraulic brake systems		e.g., ATE Part No. 3.9305-0200.4 1)
Flat double-end flare nut wrench, 9 x 11 mm		Hazet Part No. 612 2)
Container, approx. 11 for catching the brake fluid		
Brake fluid Use only DOT 4 or brake fluid from the vehicle manufacturer.		
Electrics tester or multimeter for trouble-shooting	ETE 014.00	0 684 101 400 commercially available

Aids!
Use only original brake lines from the vehicle manufacturer!

Grease for wheel-speed sensor	Molykote Longterm 2
Protective caps for brake lines	1 900 508 002 (100 pieces)
Protective caps for brake-line connections at hydraulic modulator	1 900 508 004 (100 pieces)

1) obtainable from: Alfred Teves GmbH Guerickestr. 7
D-6000 Frankfurt (Main)

2) obtainable from: Hazet Co, D-5630 Remscheid

HOW TO USE THE ABS 2 LED TESTER

1. General

The BOSCH ABS 2 LED TESTER checks the ABS components in passenger cars with hydraulic brake system.
Following BOSCH ABS systems can be checked:

* All ABS 2 versions (presently ABS 2, ABS 2B)
* ABS 2B part of the electronic traction control system (ASR)

The tester tests the peripheral system components in 6 program steps:

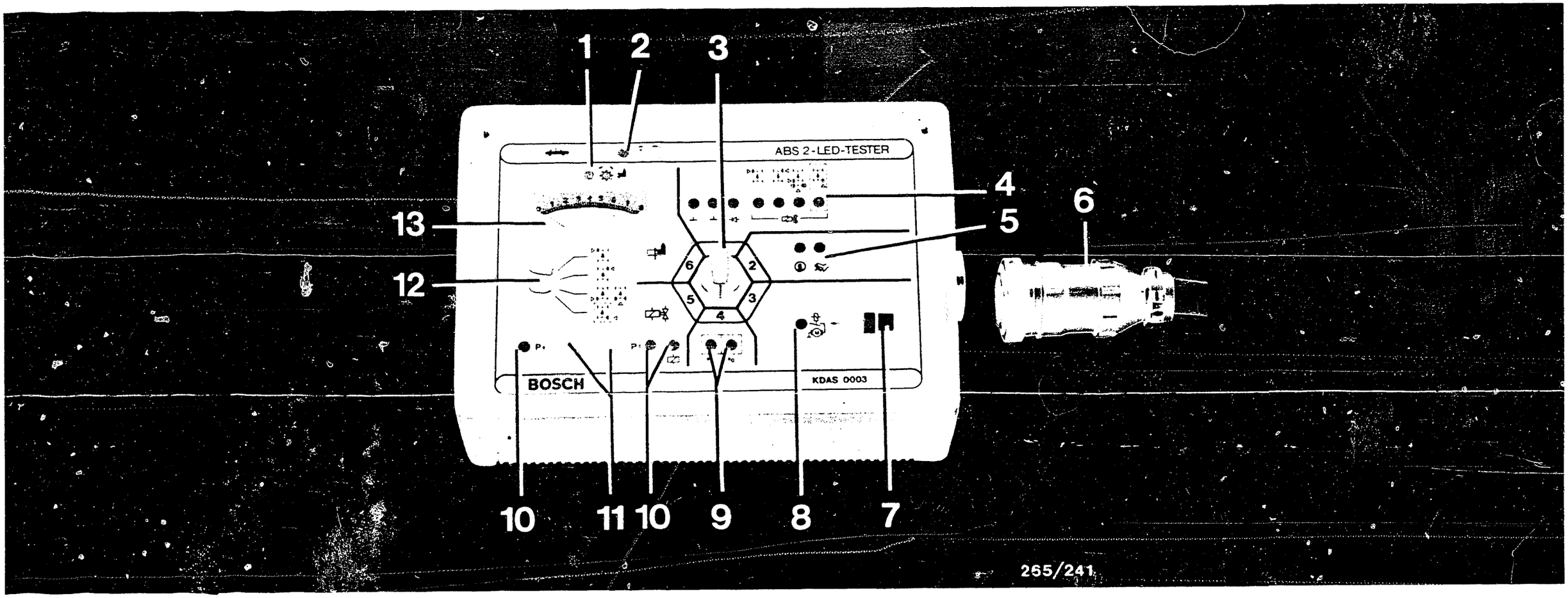
* Hydraulic modulator
* Motor relay
* Valve relay
* Wheel-speed sensors
* Warning lamp
* Acceleration sensor
* Wiring harness
* Cable connections
* Ground cables
* Stop-lamp-switch signal
* Alternator signal

The ABS controller is not tested.

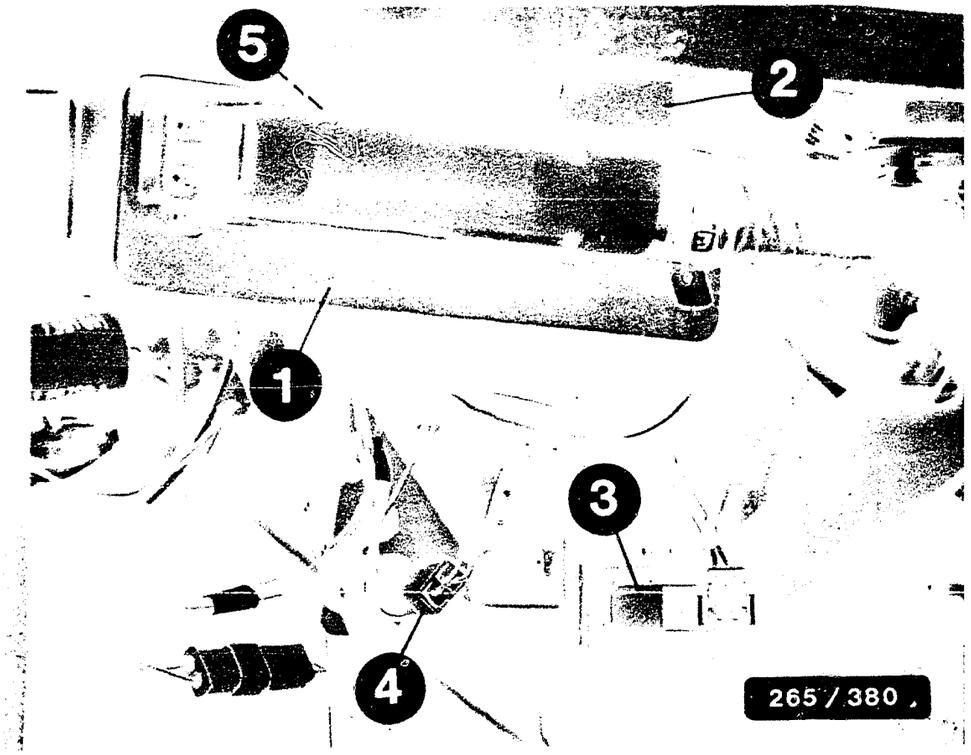
The self-diagnosis facility in the ABS controller means that an additional test of the controller with the tester is not necessary.

A brake dynamometer is not required for testing the ABS.
If a brake dynamometer is used, there is a danger of the vehicle jumping out of the rollers!
All responsibility for using a brake dynamometer lies with the test personnel.

2. Tester setup
Faults are indicated via light-emitting diodes (LEDs) with the exception of the wheel-speed-sensor signals which must be read off from the indicator instrument.



1 = 1 LED indicator for wheel speed in program-selector switch position 6
2 = 1 LED indicator for battery voltage
3 = Program-selector switch
4 = 7 LED indicators for program-selector switch position 1
5 = 2 LED indicators for program-selector switch position 2
6 = ABS adapter lead for connection to ABS wiring harness in vehicle
7 = Push-button for motor-relay activation in program-selector switch position 3
8 = 1 LED indicator for program-selector switch position 3
9 = 2 LED indicators for program-selector switch position 4
10 = 3 LED indicators for program-selector switch position 5
11 = 2 push-buttons for triggering the solenoid-operated-valve functions.
Pressure holding and pressure reduction in program-selector switch position 5
12 = Rotary switch for selection of individual wheels.
Operational in program-selector switch positions 5 and 6
13 = Indicator instrument for program-selector switch position 6



INSTALLATION POSITION OF COMPONENTS

The indications "right" and "left" always refer to the forward direction of travel.

* Controller (Item. 1):
  to the left of the steering column behind the footwell panelling.

* Overvoltage-protection relay (Item 2):
  on the right above the controller.

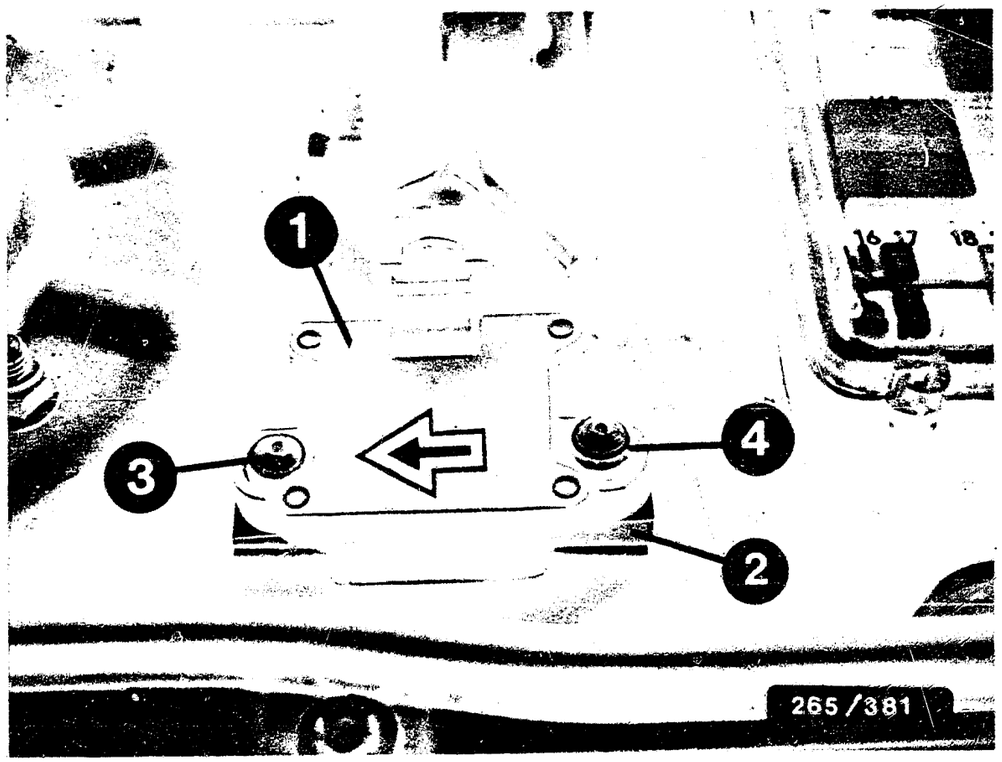
* Stop-lamp switch (Item. 3):
  on the brake pedal.

* Clutch switch (Item 4):
  on the clutch pedal.

* Ground terminal (Item 5) for ABS:
  behind the controller.

* ABS warning lamp: in the instrument panel.

* Battery: in the luggage compartment on the right.



1 = Acceleration sensor
2 = Chock
3 = Shear-head screw, front
4 = Shear-head screw, rear
Arrow = Forward direction of travel

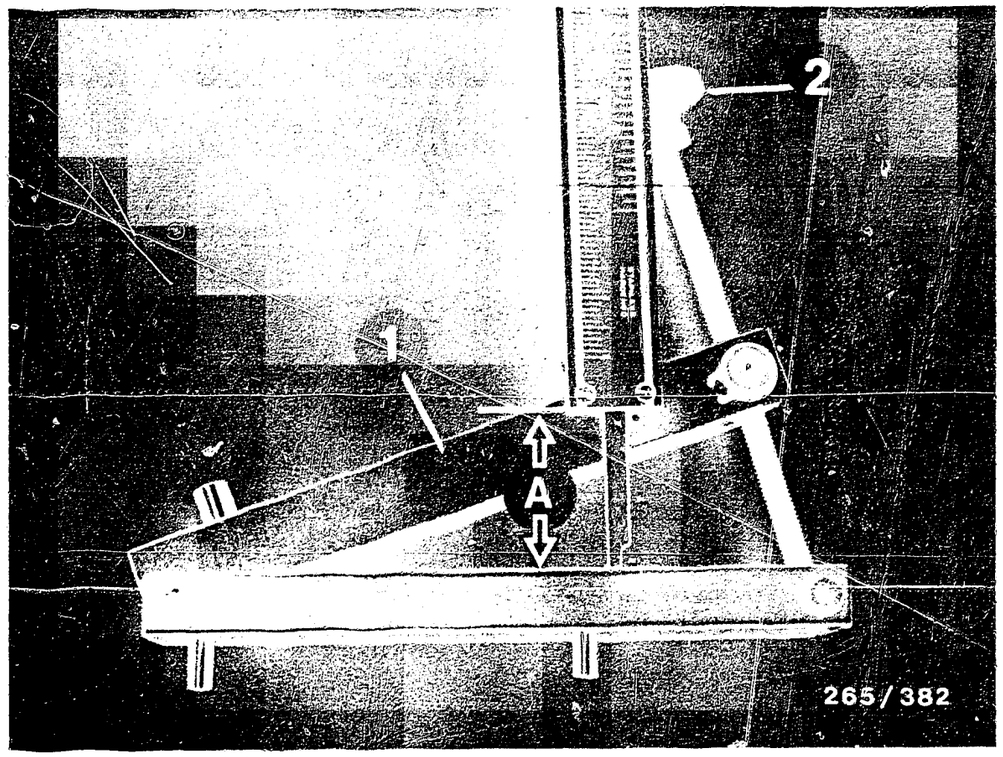
INSTALLATION POSITION OF COMPONENTS (Continued)

Exchange accelerator sensor:
drill out shear-head screws. Adjust sensor using special tool. Pay attention to direction of installation. Use new shear-head screws.

* Wheel-speed sensors, front axle:
  left and right in the steering knuckles.
  Do not mix up the left-hand and the right-hand wheel-speed sensors when installing.

* Wheel-speed sensors, rear axle:
  left and right near to the brake calipers.

* Ground cables for pump motor and valve relay (->8.87):
  in the engine compartment on the left-hand side on the bodywork.



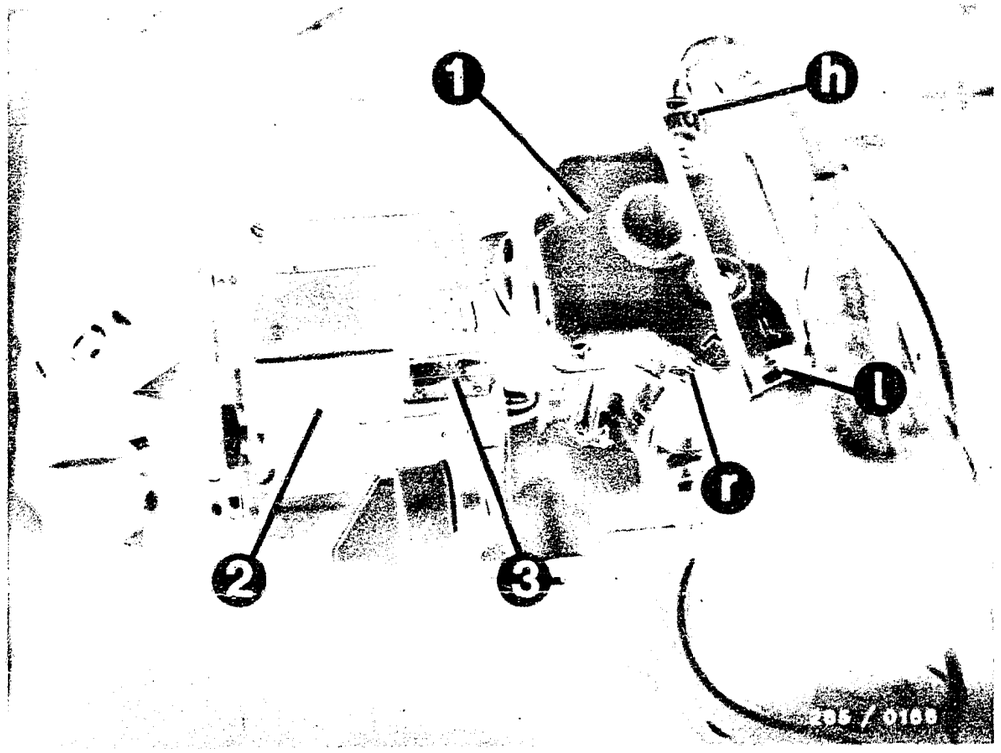
1 = Feeler gauge
2 = Adjusting screw

INSTALLATION POSITION OF COMPONENTS (Continued)

Remove tool and measure clearance A (from bolt to support bracket).

Compare actual value with set value.
Set value (dimension A): 26.5...33.0 mm.
Actual value is less than minimum set value: position support beneath forward mounting point.
Actual value is greater than maximum set value: position support beneath rear mounting point.

Compensate for difference determined using a wrench and/or plain washer. Chuck corresponds to 4.9...5.3 mm.



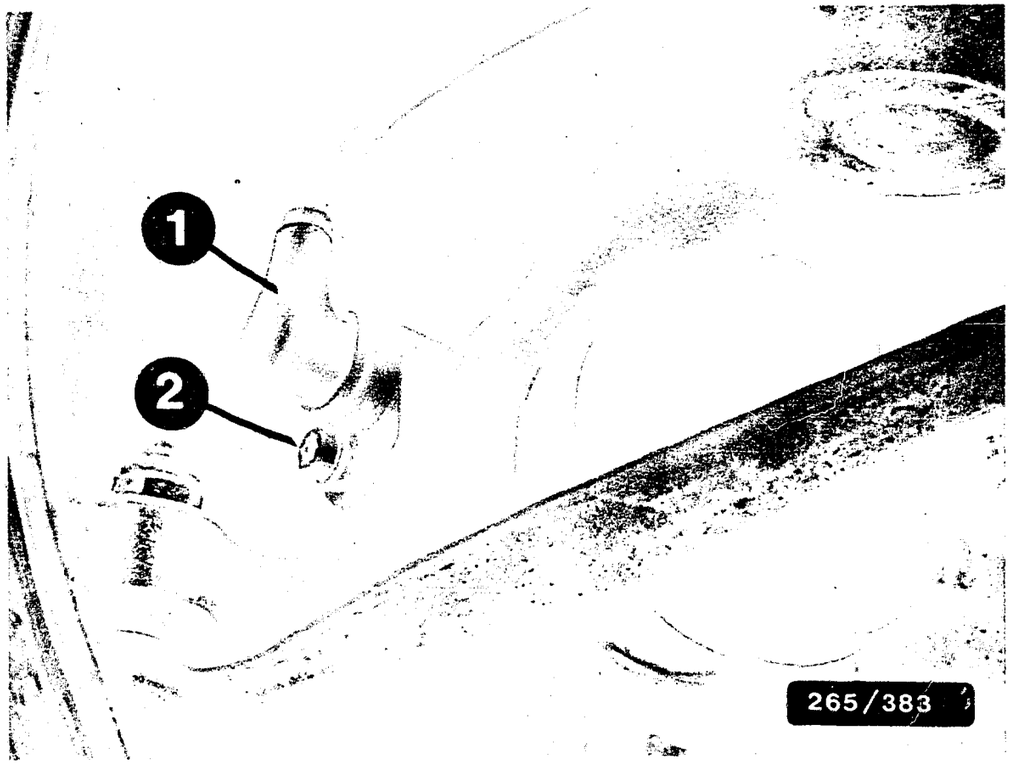
1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

INSTALLATION POSITION OF COMPONENTS (Continued)

Check switching point once again with support positioned.
Position acceleration sensor on to support and secure with shear-head screw. Screw off head of shear-head screw.
Tightening torque: 6...8 Nm.
A maximum of one wedge and 3 plain washers (each of 1 mm) is permissible.

* Hydraulic modulator:
  In the engine compartment beneath the left-hand headlamp.

  The hydraulic modulator must not be repaired, but be exchanged as a complete unit.
  Exception: exchange of the motor relay and valve relay is permitted.



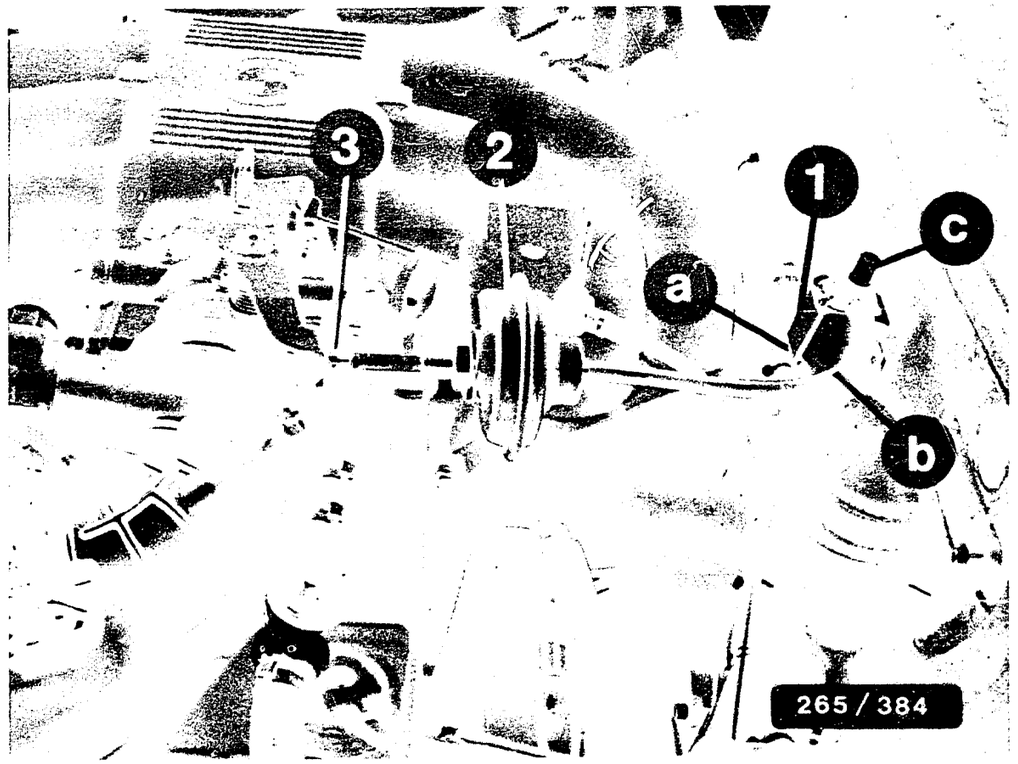
1 = Wheel-speed sensor, front right
2 = Fastening screw

INSTALLATION POSITION OF COMPONENTS (Continued)

* Ground cables for pump motor and valve relay (->8.87):
  In the engine compartment on the left-hand side of the bodywork.

* Wheel-speed sensors, front axle:
  One on each side in the steering knuckles.
  Do not mix up the wheel-speed sensors when installing, since this would make the air gap too wide and the signal too small.
  Wheel-speed-sensor plug-in connections in front of the left-hand spring-strut dome and on the right beneath the fluid reservoir.

* Wheel-speed sensors, rear axle:
  One on each side on the wheel hubs in front of the drive shaft.
  Wheel-speed-sensor plug-in connections behind the lead-through in the floor panel.



1 = Solenoid-operated valve
a = Vacuum line to intake manifold
b = Vacuum line to actuator
c = Ventilation to atmosphere
2 = Throttle-valve actuator
3 = Adjusting screw

INSTALLATION POSITION OF COMPONENTS (Continued)

Adjust throttle-valve actuator (if present):
Run engine at idle speed and disconnect vacuum hose from actuator.
Idle speed must increase to 2400 +100 min^{-1} .
Engine speed may be adjusted via the throttle-valve-actuator adjusting screw.

OPERATION AND TESTING OF THE ABS WARNING LAMP

ABS warning lamp

With the ignition switched on, the warning lamp marked with the letters "ABS" in the instrument panel lights up.
After the engine has been started and the idle speed reached, the ABS warning lamp goes out (terminal 61 of alternator supplies voltage to the ABS controller).
When the vehicle exceeds a speed of approx. 6 km/h with all 4 wheels for the first time, the ABS system conducts a test of itself automatically (BITE procedure).
This procedure is repeated each time after the ignition is switched off and the engine restarted.
In addition, the ABS permanently conducts checks on itself within a certain scope while the vehicle is being driven.

Incorrect warning-lamp indications are:

* Warning lamp does not light up after swtching on ignition.
* Warning lamp does not go out after reaching idle speed.
* Warning lamp lights up when driving or lights up occasionally.

Lighting-up of the ABS warning lamp indicates to the driver that the ABS is defective.

Nevertheless, braking can still take place with the conventional brake system.

However, it is possible for the wheels to lock.

General information:

Occasional lighting up of the warning lamp may be brought about through the battery being insufficiently charged.

The lamp lights up only as long as there is under-voltage, e.g. after switching on consuming devices when at idle.

The causes of trouble can be determined with the assistance of the ABS tester.

TEST REQUIREMENTS FOR TESTING WITH
ABS2 LED TESTER

* Regulatory tire size fitted?

* Check for firm seating of ground of return-supply pump.

* Check for firm seating and corrosion of ground of overvoltage-protection relay term. 31.

* Check for firm seating of ground strap between engine block and vehicle frame.

* Check for leaks in hydraulic connections at hydraulic modulator and sealing points (visual examination).

* If the ABS warning lamp lights up intermittently when driving (e.g. after switching on loads) and goes out again by itself, check the battery and power supply (alternator, regulator and voltage drops).

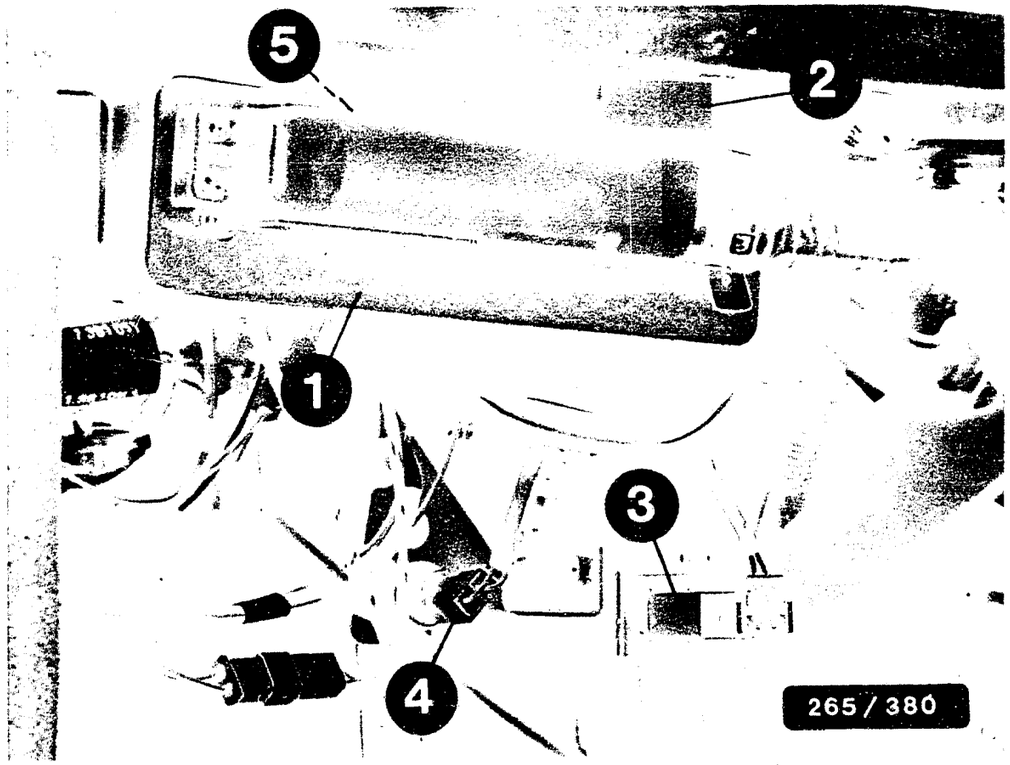
* If the ABS warning lamp lights up constantly and does not go out, check the following points:

- Controller plug sitting correctly on controller and latched?

- All plug contacts O.K.?

- Spring contacts latched?

- Check installation position for correct seating of seal ring in controller plug, rounded side downward.



1 = Controller for ABS

- Test wheel-speed-sensor leads at controller plug for correct assignment.

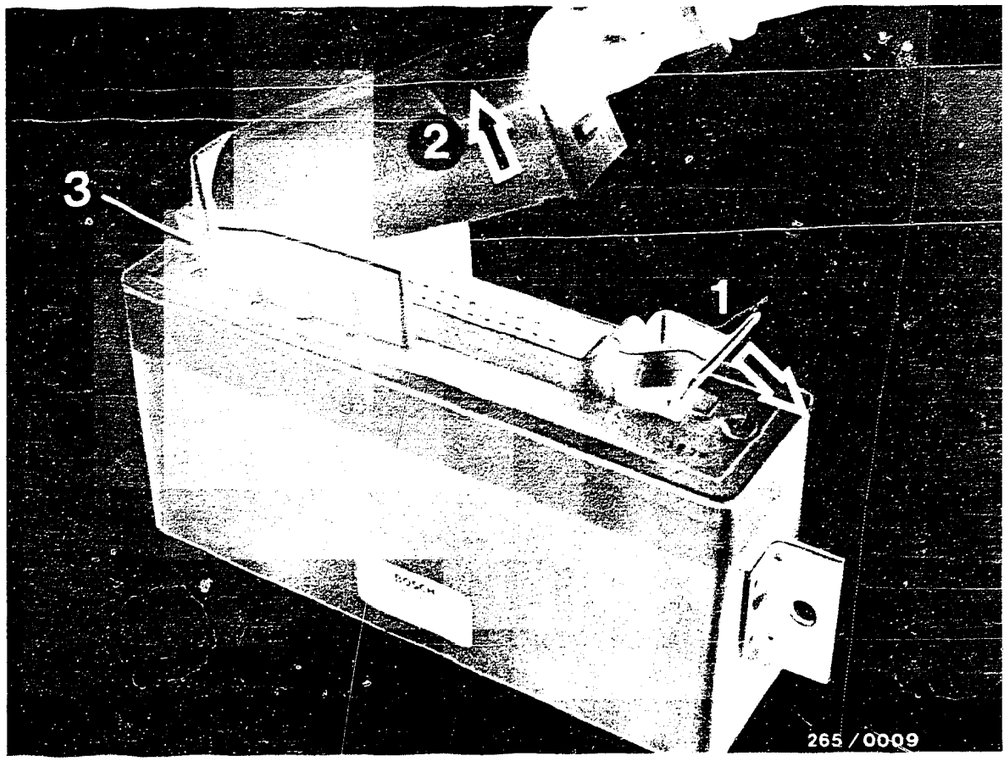
  Wheel-speed sensors:
  front left to term. : see brief instructions
  front right to term. : see brief instructions
  rear left to term. : see brief instructions
  rear right to term. : see brief instructions
  rear axle to term. : see brief instructions

- V-belt snapped?
  (Alternator supplies no voltage, charge-indicator and ABS warning lamps light up).

* Connect LED tester to ABS wiring harness.

CAUTION!

Disconnect and connect the controller only when the ignition is switched off.



1 = Spring
2 = Controller plug (35-pin)
3 = Encoding block

Disconnecting controller plug:

Push back spring, fold back controller plug and unhook from encoding block.

* For checking with tester, switch on ignition in all program-selector-switch positions (tester operates with current supply from vehicle battery).

* One LED (green) indicates whether the voltage is sufficient.

Caution!

Do not run with tester connected!

After each repair, repeat the complete test program.

General note for trouble-shooting

Check all leads for short circuit to ground and contact with positive leads and watch out for rubbed and pinched locations.

TEST CHART FOR ABS 2 LED TESTER

TEST STEP 1 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Operation

Voltage supply (term. 20 and term. 1)

* Operation: Position:

Program switch	all
Push-button	

* Operation in vehicle:
Ignition on.

* Test specification (indication)
LED 1 (upper illustration) lights up continuously in all program-selector-switch positions.

N>

Trouble-shooting:

Switch off ignition!

No reading:

* Controller plug not connected properly.
* Fuse in overvoltage-protection relay defective.
* Overvoltage-protection relay defective: exchange.

Check the following lines:

* Positive cable from B+ to overvoltage-protection relay term. 30
* Negative lead from over-voltage protection relay term. 31 to ground.
* ABS ground terminal must be bare metal and must have no contact resistance.
* Positive lead from over-voltage-protection relay term. 30a to controller plug X1/term. 1.

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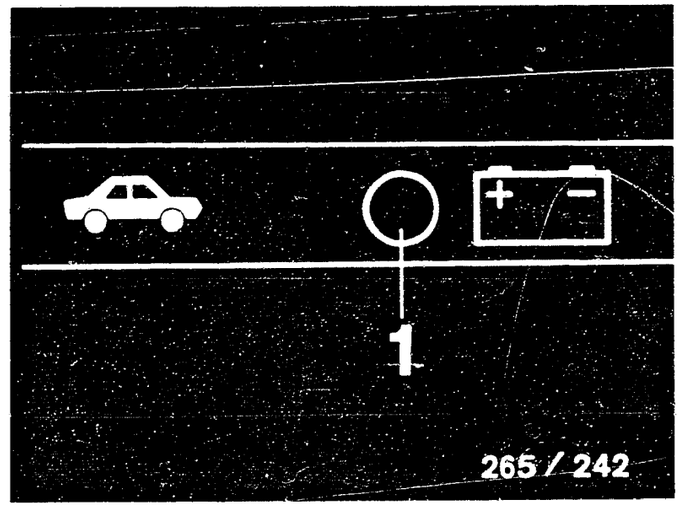
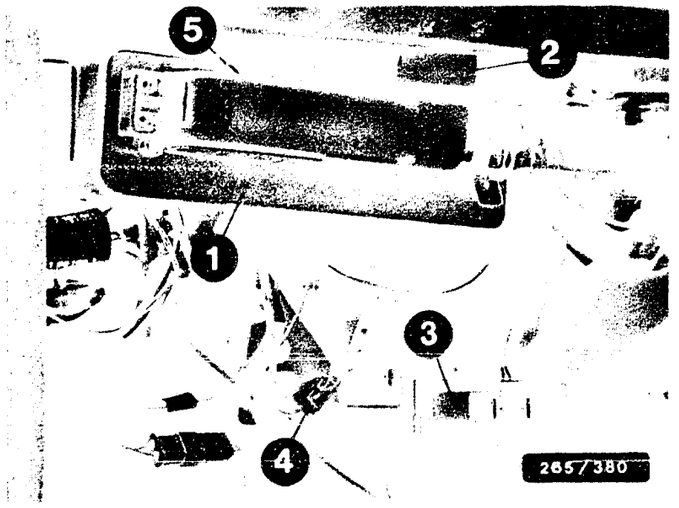


1 = LED for supply voltage

1 = ABS controller
2 = Over-voltage protection relay



* Positive lead from overvoltage-protection relay term. 86 to driving switch term. 15.

* Test for firm seating of ground strap between engine block and vehicle frame.

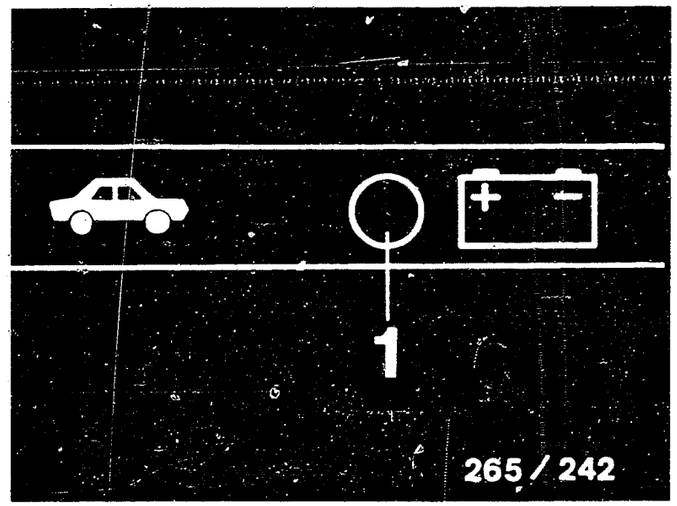
LED 1 (green) lights up occasionally during the test procedure:

* Interrupt test and eliminate fault.

Causes of fault:

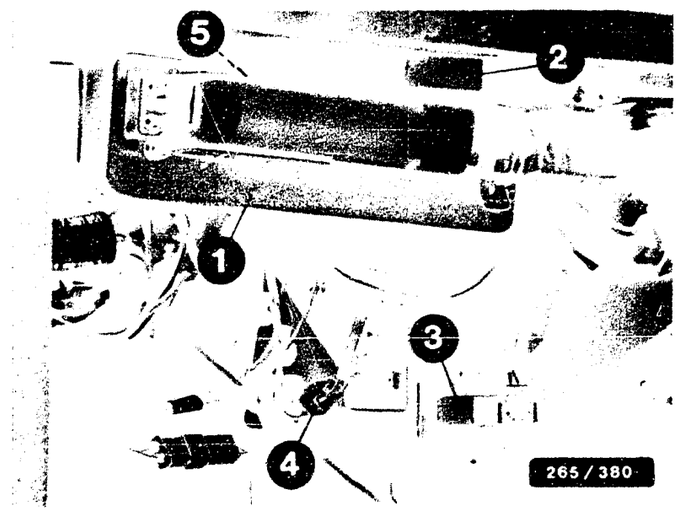
1. Battery insufficienctly charged.
   Charge battery or leave engine running.
2. Voltage drops at ABS ground terminal too high, ground terminal must be bare metal.

After eliminating the fault, conduct the complete test program.



1 = LED for supply voltage

1 = ABS controller
2 = Over-voltage protection relay



TEST STEP 2 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component/Operation:

Ground (term. 34, term. 10)
Diode for warning lamp (term. 29, term. 32)
Solenoid-valve internal resistances term. 2, term. 35, term. 18.
Off-position and ground of valve relay.
ABS warning lamp.

* Operation:	Position:
Program switch	1
Push-button	—

* Operation in vehicle:
  Ignition on.

* Test specification (indication)
  LED 1 up to LED 4.3 light up equally brightly (see upper illustration).

ABS warning lamp in vehicle must light up.

N>

Trouble-shooting:

Switch off ignition!

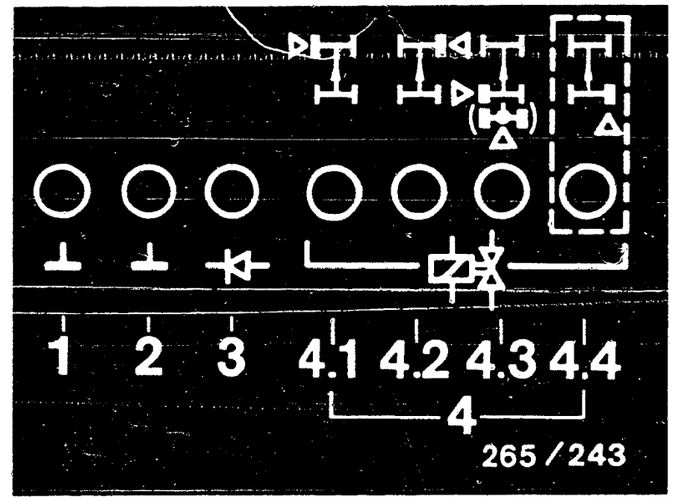
1. LED 1 and / or 2 (upper illustration) do(es) not light up:

* Test ground terminal behind control unit and ground strap between engine block and vehicle frame for proper seating, excessive contact resistance and open circuit.

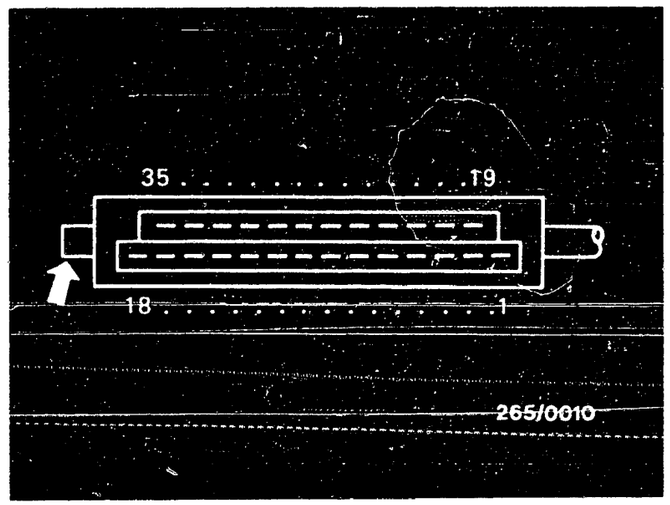
* Test lead from controller plug X1/term. 10 to ground terminal for contact resistance and open circuit.

* Test lead from controller plug X1/term.34 to ground terminal for contact resistance and open circuit.

* Valve relay defective.
  ATTENTION!
  There are two different relays which are not interchangeable with each other (i.e. different).



Plan view of controller plug X1 (35-pin) with terminal numbers.
Arrow = Lug with mechanical encoding



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V

2.LED 3 does not light up:

* Measure diode in forward and reverse directions using ohmmeter.
  Up to 08.87: diode in hydraulic modulator.
  Conduct measurement at hydraulic modulator between term. 4 and term. 7.
  If diode defective, exchange hydraulic modulator.
  As of 08.87: diode in valve relay.
  Conduct measurement at valve relay between term. L1 and term. 30.
  If diode defective, exchange relay.

* Test frame connection of valve relay for contact resistance and open circuit.
  Up to 08.87: from hydraulic-modulator plug term. 8 to ground terminal.
  Up to 08.87: from valve-relay plug term. 87a to ground terminal of pump motor.

V

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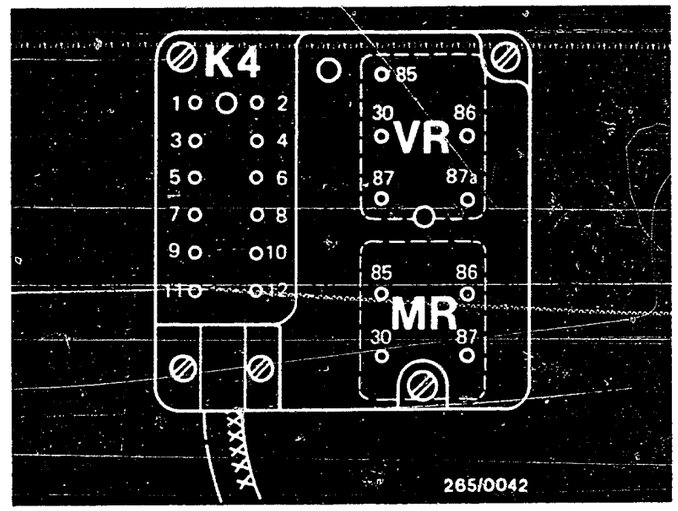
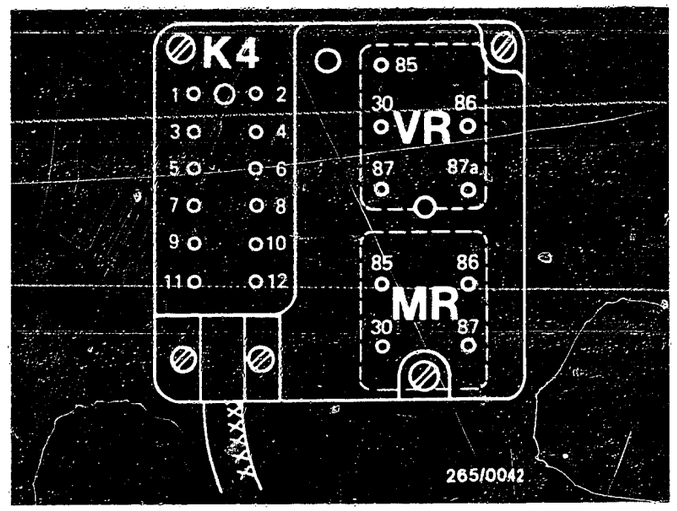


Pluggable printed-board assembly of hydraulic modulator, position of terminals: VR = Valve relay
MR = Motor relay
K4 = Hydraulic-modulator plug

3. One or more LEDs no. 4 do(es) not light up.

* Measure internal resistance directly at hydraulic modulator.
Test specifications: see brief instructions.
Valve l (LED 4.1) between term. 1 and term. 4.
Valve r (LED 4.2) between term. 3 and term. 4.
Valve h (LED 4.3) between term. 5 and term. 4.
If test specification is not obtained:
exchange hydraulic modulator.



Pluggable printed-board assembly of hydraulic modulator, position of terminals: VR = Valve relay
MR = Motor relay
K4 = Hydraulic-modulator plug

Continued on next picture page

* Test leads for continuity (test specification 0 Ω):

  Valve 1 (LED 4.1):
  from hydraulic-modulator plug term. 1 to controller plug X1/term. 2.
  Valve r (LED 4.2):
  from hydraulic-modulator plug term. 3 to controller plug X1/term. 35.
  Valve h (LED 4.3):
  from hydraulic-modulator plug term. 5 to controller plug X1/term. 18.

If test specification is not obtained:
test plug-in connections for open circuit, corrosion and mechanical defects, and eliminate open circuit.

4. All LEDs no. 4 and 3 do not light up:

* Test frame connection of valve relay for contact resistance and open circuit.

* Valve relay defective.

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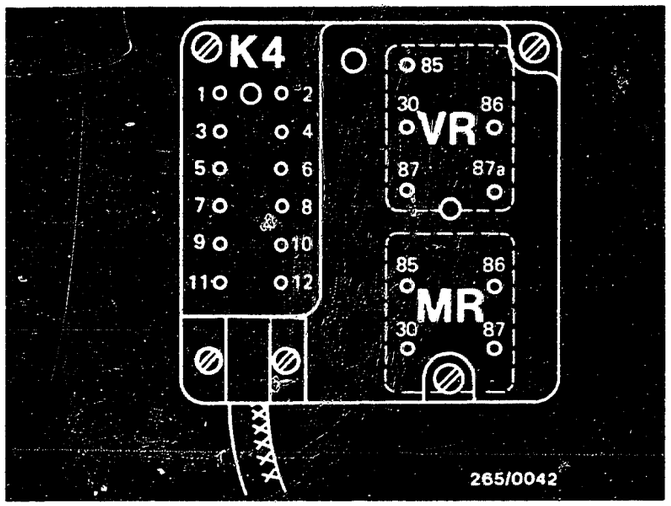
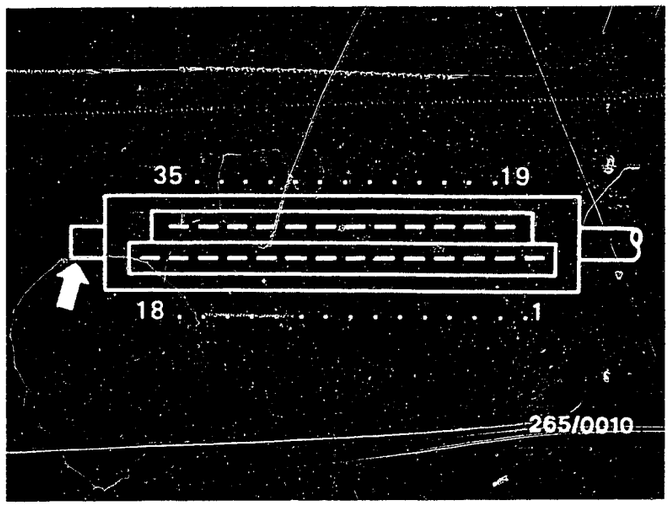


Pluggable printed-board assembly of hydraulic modulator, position of terminals: VR = Valve relay
MR = Motor relay
K4 = Hydraulic-modulator plug

Plan view of controller plug X1 (35-pin) with terminal numbers.
Arrow = Lug with mechanical encoding



TEST STEP 2 (CONTINUED 4) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

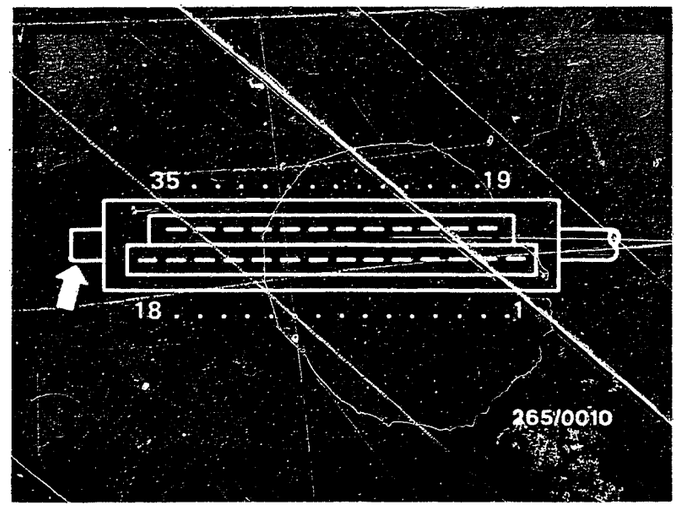
4. Weak lighting of a LED:

* This means contact resistance in corresponding current path.

5. ABS warning lamp does not light up:

* Warning lamp defective.

* Test lead from the warning lamp to driving switch term. 15 and to controller plug X1/term.29 .
Note:
All other 6 LEDs must light up.



Plan view of controller plug X1 (35-pin) with terminal numbers.
Arrow = Lug with mechanical encoding

Continued on next picture page

B19 — <⟹>

B20 — <⟹>

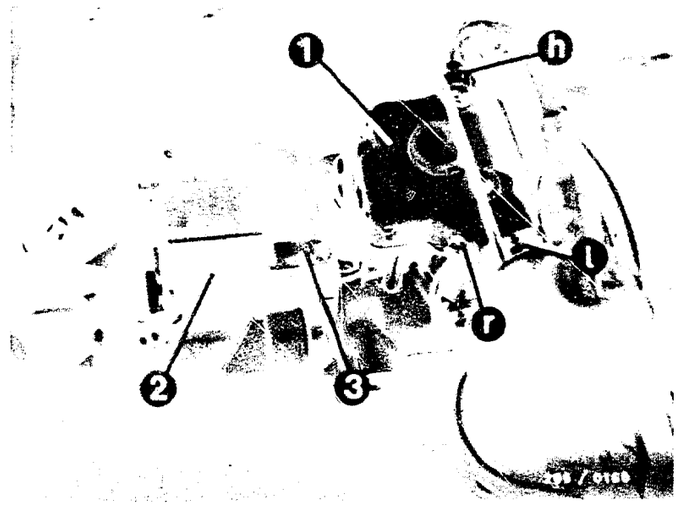
Removing the hydraulic modulator:

* For reasons of safety, the hydraulic modulator must not be repaired, but be exchanged as a complete unit.

  Excepted from this are the motor and valve relays (upper illustration). Both relays may be exchanged.

* Apart from the brake-line connections, no screws on the hydraulic modulator must be loosened. In particular, the hexagon-socket-head cap screws and Torx screws must under no circumstances be loosened (upper illustration). Once they are loosened, it is impossible to make the brake circuits leak-free ever again. D A N G E R O F F A T A L A C C I D E N T !

* Check the hydraulic modulator and brake-line connections visually for leaks. If brake fluid is escaping, the brake-line connections must be tightened (see brief instructions) or replaced, and the hydraulic modulator exchanged.



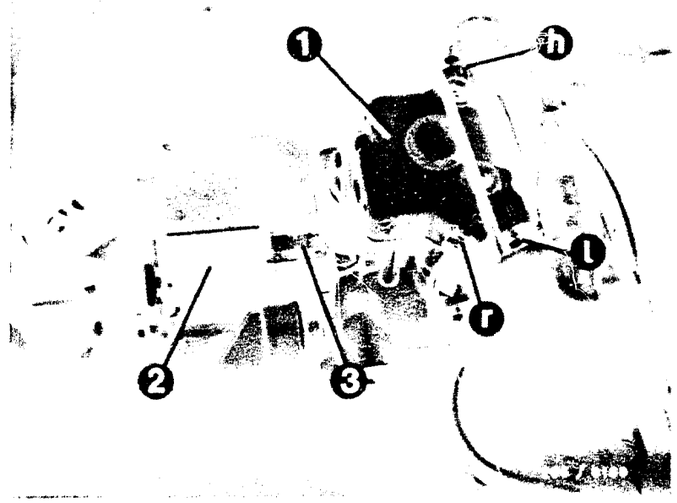
1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

Continued on next picture page

Located at the base of the hydraulic modulator is a ventilation bore to the pump plunger. It is possible for a small amount of brake fluid to escape at this location. A complaint in this regard is justified only if a pool of brake fluid forms beneath the hydraulic modulator after the brake pedal is actuated several times.

* When removing and installing the brake linings, make sure that the lines are marked with the corresponding marking on the hydraulic modulator and re-connected correctly assigned (e.g. "1" from the hydraulic modulator must be connected to the front left wheel-brake cylinder).

* Markings on hydraulic modulator (see illustration):
  - l = Connection for front left brake line (wheel-brake cylinder)
  - r = Connection for front right brake line (wheel-brake cylinder)
  - h = Connection for brake line of rear axle
  - V = Front-axle brake circuit from brake master cylinder
  - H = Rear-axle brake circuit from brake master cylinder



1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

Continued on next picture page

* Use only the specified box wrench for loosening and tightening the brake lines.

* Mark the brake lines and loosen them from the hydraulic modulator.

* Catch the brake fluid and do not allow it to come into contact with skin, clothing or paintwork!

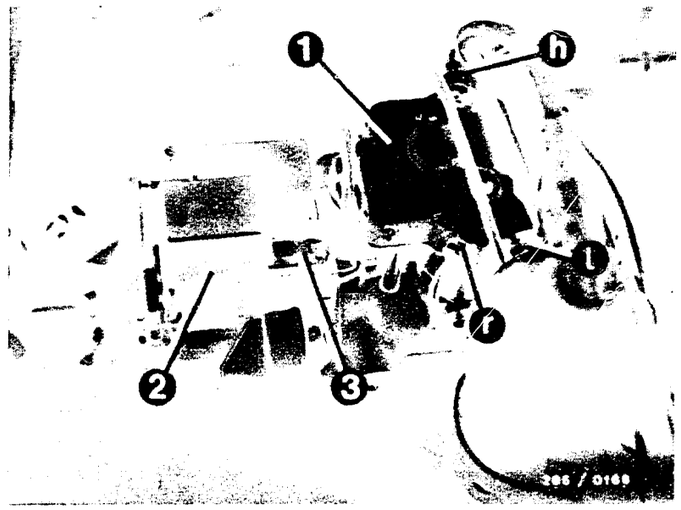
* Immediately seal off the brake lines and connections with dummy plugs.

* Disconnect ground cable from the pump motor.

* Loosen fastening screws and remove cover.

* Loosen clip and remove the plug.

* Loosen hexagon nuts from bracket and remove hydraulic modulator.



1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

Continued on next picture page

Installing

* Insert hydraulic modulator into the bracket and tighten with the hexagon nuts.

* Connect ground cable to pump motor.
  Connect 12-pin plug and secure with the clip.

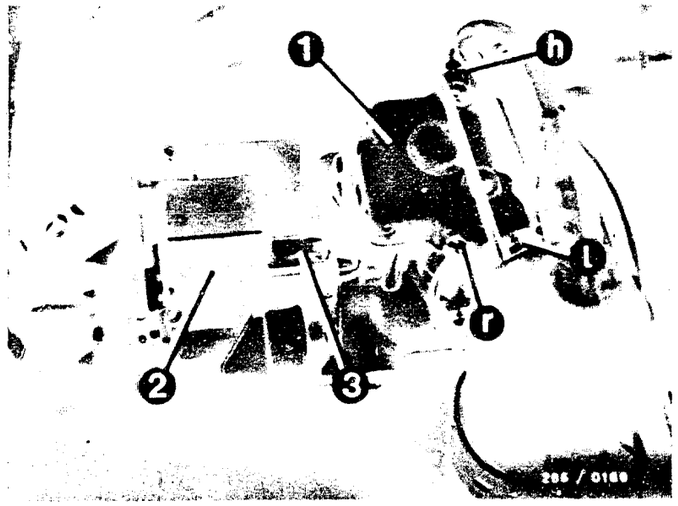
* Secure cover with the screw on the hydraulic modulator.

* Connect brake lines to the hydraulic modulator in accordance with the markings.

* Observe tightening torques for brake-line connections at the hydraulic modulator.

* Bleed the brake system of air and test for leaks.

* Check the ABS completely with the tester.



1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

TEST STEP 3 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component/Operation:

Generator voltage of term. 61 (term. 15)

* Operation: Position:
  Program switch 2
  Push-button –

* Operation in vehicle:
  Ignition on.

* Test specification (indication):
  LED 1 (upper illustration) lights up.

* Operation in vehicle:
  Start engine.

* Test specification (indication)
  LED 1 (upper illustration) goes out when engine running.

N

Trouble-shooting:

LED 1 does not go out when engine running:

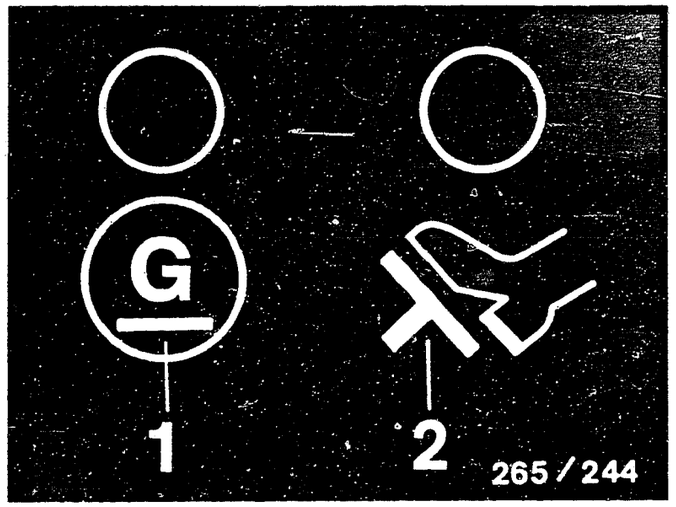
* Briefly accelerate.
  If LED 1 goes out, test is O.K.

* Voltage measurement at K1/ term. 15 with engine running.
  Test specification: greater than 10 V.

* Oscilloscope measurement at K1/ term. 15 with engine running.

* Voltage smaller than 10 V or pattern indicating defects.

* Repair generator and/or lead.



Y

V

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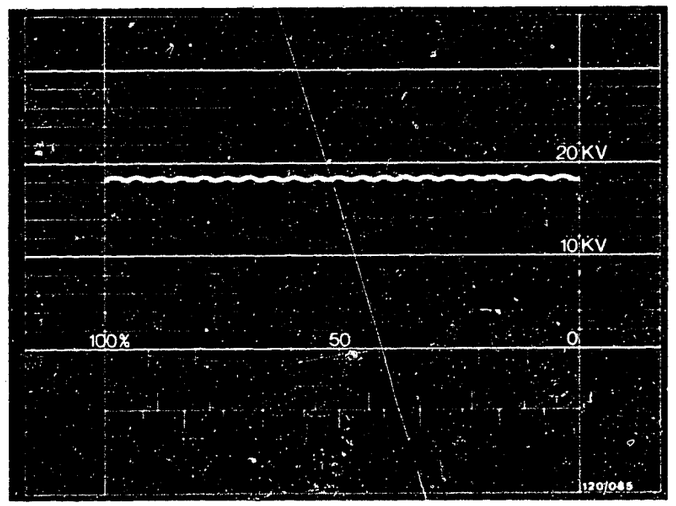


Component/Operation:

Stop-lamp switch term. 25.

* Operation:	Postion:
Program switch	2
Push-button	–

* Operation in vehicle:
  Ignition on.

* Test specification (indication):
  LED 2 (upper illustration) lights up.

* Operation in vehicle:
  Actuate brake pedal.

* Test specification (indication)
  LED 2 (upper illustration) goes out.

N>

Trouble-shooting:

1. LED 2 does not light up:

* Stop lamps defective.
  High contact resistance of stop lamps or of their ground.
  Break in line from controller term. 25 to stop-lamp switch.

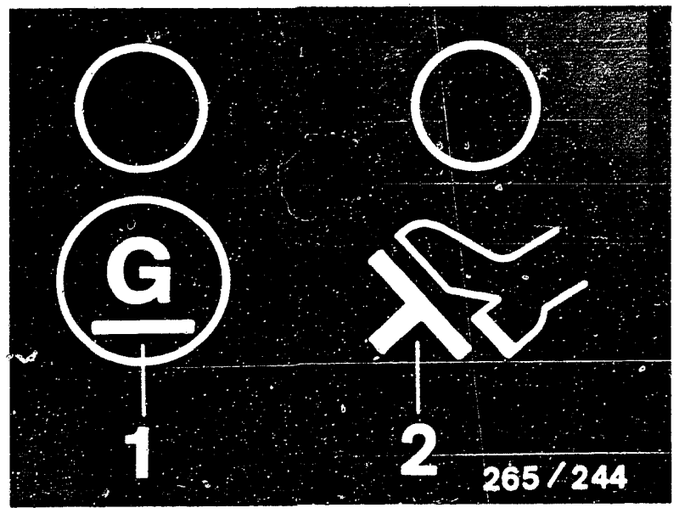
2. LED does not go out or becomes only slightly darker:

* Fuse for stop-lamp switch defective.

* Voltage drop at stop-lamp switch (switch defective) or its plug connections.

* Stop-lamp switch defective.

* Lead to stop-lamp switch connected incorrectly.



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TEST STEP 4 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Operation:

Pump-motor motor relay in hydraulic modulator
(term.28, term.14).

* Operation:	Position:
Program switch	3
Push-button (upper ill.)	2

* Operation in vehicle:
  Ignition on.
  Keep push-button 2 (upper ill.) pressed.

* Test specification (indication):
  LED 1 lights up, pump motor runs.

  After releasing the push-button, LED 1 stays lit due to run-on of motor (upper illustration).

Continued C17

N>

Trouble-shooting:

Switch off ignition:

1. LED does not light up or pump motor does not start:

* Motor relay defective (lower illustration).

* Test following leads for continuity:

  From controller plug X1/term. 14 to hydraulic-modulator-plug term. 9 .
  From hydraulic modulator term.9 to motor relay term. 30.

  From overvoltage-protection relay term.30 to Y2/term. 10

  From hydraulic modulator term. 10 to motor relay term. 86
  From motor relay term. 85 to hydraulic modulator term. 11

  From Y2/term. 11 to controller plug X1/term. 28

  From motor relay term. 87 to X1/term. 12.

  From Y2/term. 12 to term. B+.

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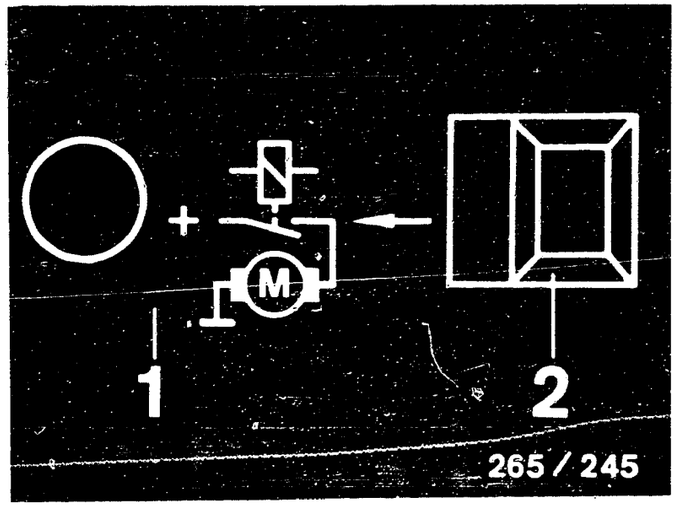
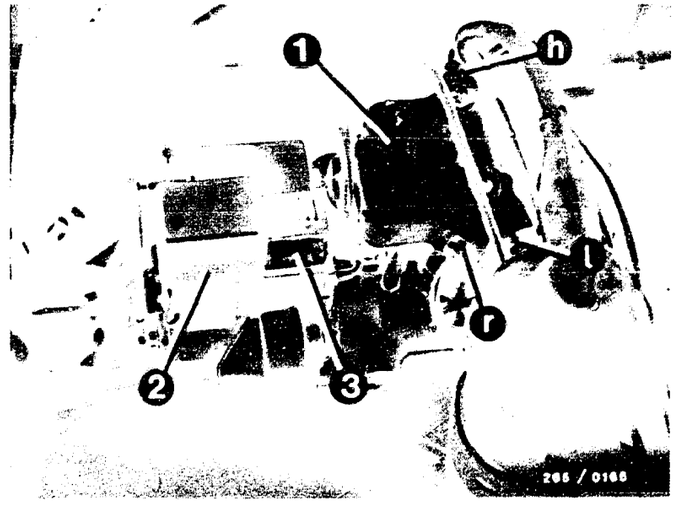


1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

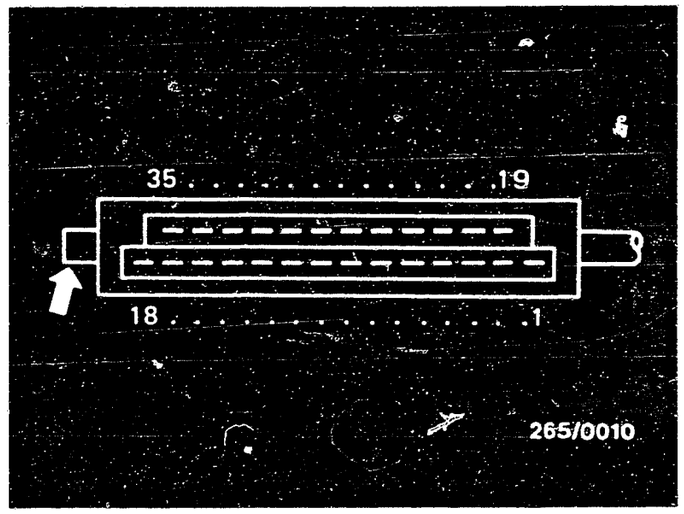


2. Pump motor does not run or LED does not stay lit or stays lit very briefly:

* Check for firm seating of ground terminal of pump motor and test contact resistance.

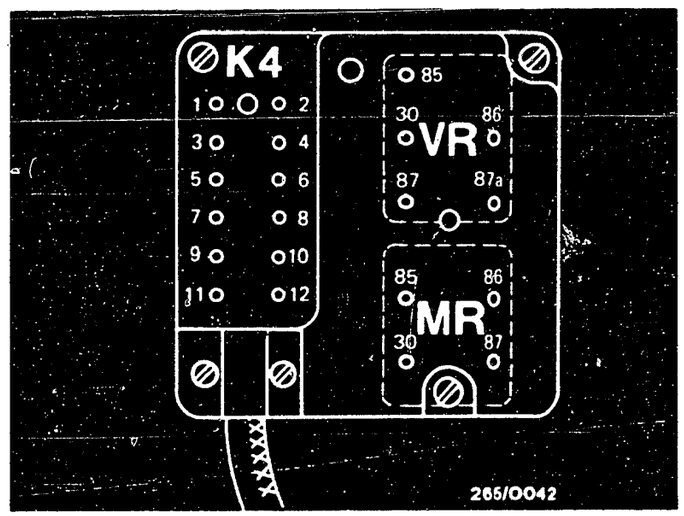
* Test for firm seating of positive connection of pump motor. Test lead from positive connection of pump motor to motor relay term. 30. Test pump motor for continuity.

* Pump motor defective: exchange hydraulic modulator.



Plan view of controller plug X1 (35-pin) with terminal numbers.
Arrow = Lug with mechanical encoding

Pluggable printed-board assembly of hydraulic modulator, position of terminals: VR = Valve relay
MR = Motor relay
K4 = Hydraulic-modulator plug



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Removing the hydraulic modulator:

* For reasons of safety, the hydraulic modulator must not be repaired, but be exchanged as a complete unit.

  Excepted from this are the motor and valve relays (upper illustration). Both relays may be exchanged.

* Apart from the brake-line connections, no screws on the hydraulic modulator must be loosened. In particular, the hexagon-socket-head cap screws and Torx screws must under no circumstances be loosened (upper illustration). Once they are loosened, it is impossible to make the brake circuits leak-free ever again. D A N G E R O F F A T A L A C C I D E N T !

* Check the hydraulic modulator and brake-line connections visually for leaks. If brake fluid is escaping, the brake-line connections must be tightened (see brief instructions) or replaced, and the hydraulic modulator exchanged.

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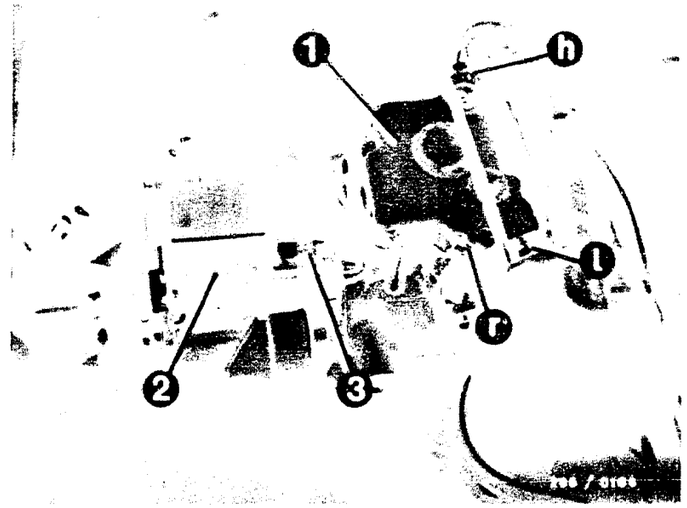
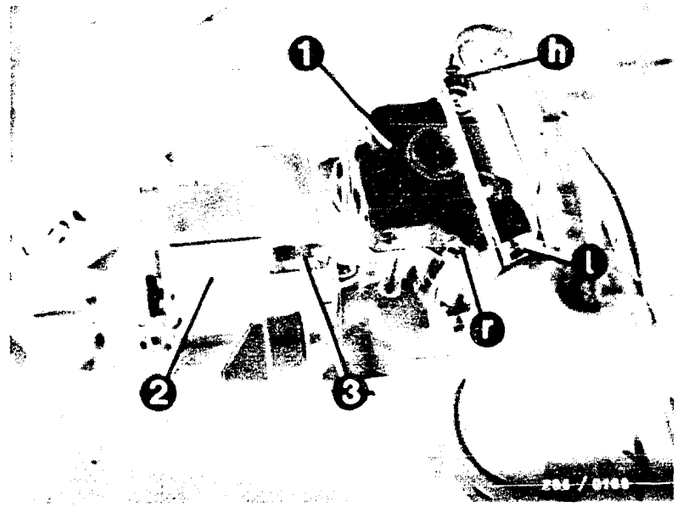


1 = Hydraulic modulator
2 = Valve relay
3 = Motor relay
Arrows = Do not loosen these screws.

Located at the base of the hydraulic modulator is a ventilation bore to the pump plunger. It is possible for a small amount of brake fluid to escape at this location. A complaint in this regard is justified only if a pool of brake fluid forms beneath the hydraulic modulator after the brake pedal is actuated several times.

* When removing and installing the brake linings, make sure that the lines are marked with the corresponding marking on the hydraulic modulator and re-connected correctly assigned (e.g. "1" from the hydraulic modulator must be connected to the front left wheel-brake cylinder).

* Markings on hydraulic modulator (see illustration):
  - l = Connection for front left brake line (wheel-brake cylinder)
  - r = Connection for front right brake line (wheel-brake cylinder)
  - h = Connection for brake line of rear axle
  - V = Front-axle brake circuit from brake master cylinder
  - H = Rear-axle brake circuit from brake master cylinder



1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

Continued on next picture page

* Use only the specified box wrench for loosening and tightening the brake lines.

* Mark the brake lines and loosen them from the hydraulic modulator.

* Catch the brake fluid and do not allow it to come into contact with skin, clothing or paintwork!

* Immediately seal off the brake lines and connections with dummy plugs.

* Disconnect ground cable from the pump motor.

* Loosen fastening screws and remove cover.

* Loosen clip and remove the plug.

* Loosen hexagon nuts from bracket and remove hydraulic modulator.

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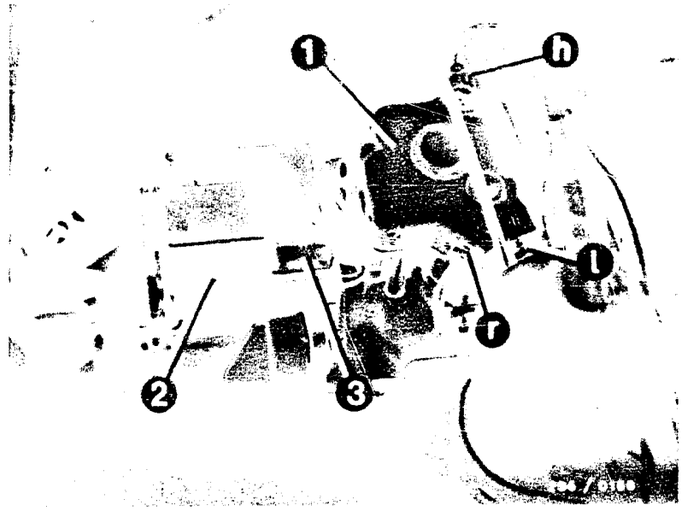


1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

Installing

* Insert hydraulic modulator into the bracket and tighten with the hexagon nuts.

* Connect ground cable to pump motor.
  Connect 12-pin plug and secure with the clip.

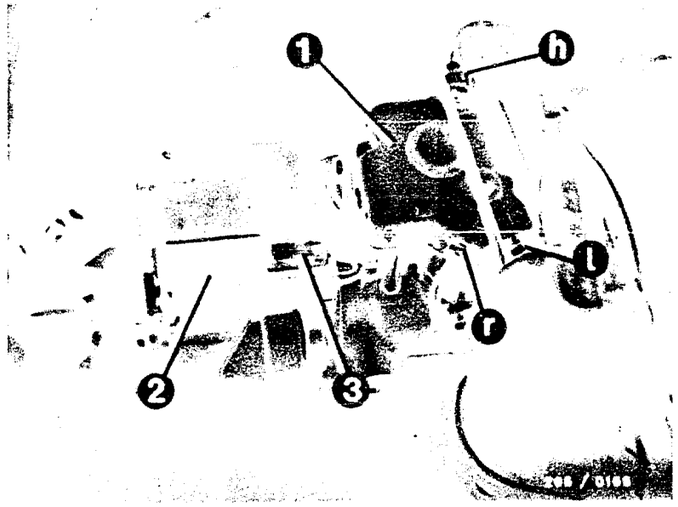
* Secure cover with the screw on the hydraulic modulator.

* Connect brake lines to the hydraulic modulator in accordance with the markings.

* Observe tightening torques for brake-line connections at the hydraulic modulator.

* Bleed the brake system of air and test for leaks.

* Check the ABS completely with the tester.



1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

TEST STEP 5 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Function:

Acceleration sensor a_L
term. 16

* Operation: Position:
  Prog.-selec. switch | 4 |
  Push-button | — |

* Operation in vehicle:
  ignition on.

* Test specification (reading):
  LED a_L (upper illustration)
  lights up.

N>

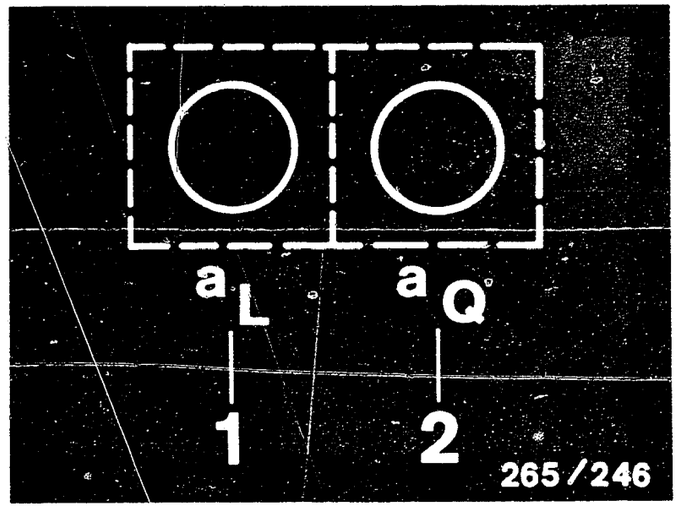
LED a_L (upper illustration)
does not light up:

* Test acceleration sensor with ohmmeter:
  Set value: less than 100 Ω
* Set value is not obtained:
  exchange sensor.

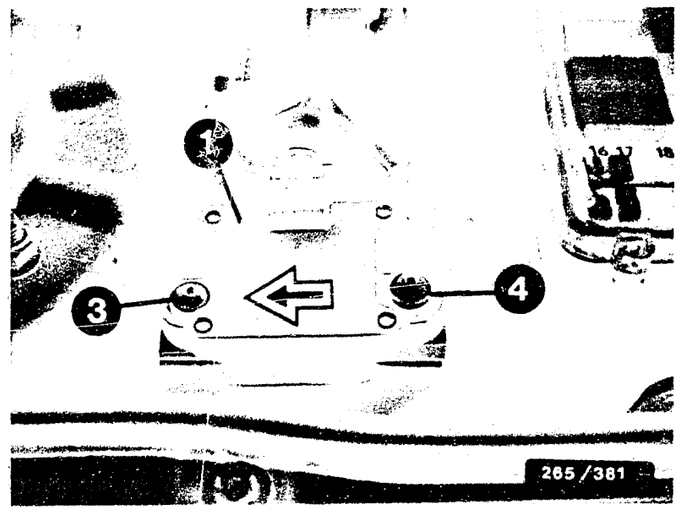
Test following leads for contact resistance and open circuit:

* Lead from controller plug X1/term. 16 to acceleration sensor.

* Lead from controller plug X1/term. 1 to acceleration sensor.



1 = Acceleration sensor
2 = Chock
3 = Shear-head screw, front
4 = Shear-head screw, rear
Arrow = Forward direction of travel



Continued C23

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Removing acceleration sensor:
Disconnect plug.
Drill out shear-head screws.

Adjusting new acceleration sensor:

Position the vehicle on a flat base. Further conditions: vehicle unladen, fuel tank full, or corresponding weight in trunk. Tire pressure O.K.

Position acceleration sensor on mounting block using special tool. Pay attention to direction of installation.

Connect ohmmeter to sensor. Turn screw on tool until reading jumps from less than 100 Ω (contact closed) to infinity.

Remove tool and measure clearance A (from bolt to seating bracket).

Compare actual value with set value.
Set value (dimension A):
26,5...33,0 mm
Actual value less than minimum set value: position support beneath forward mounting point.

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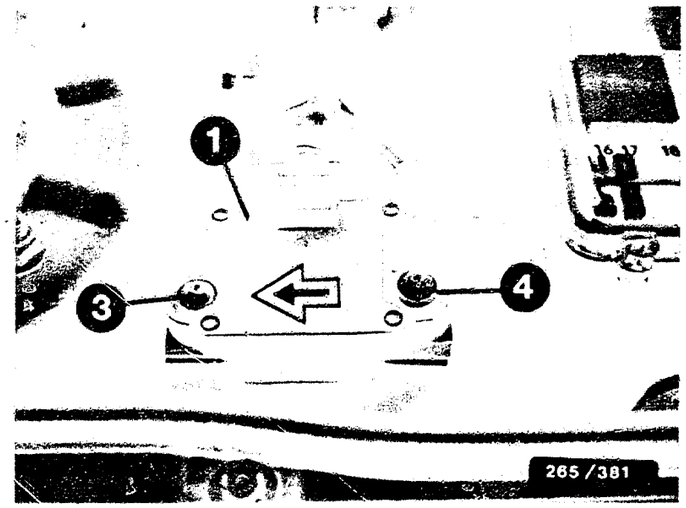
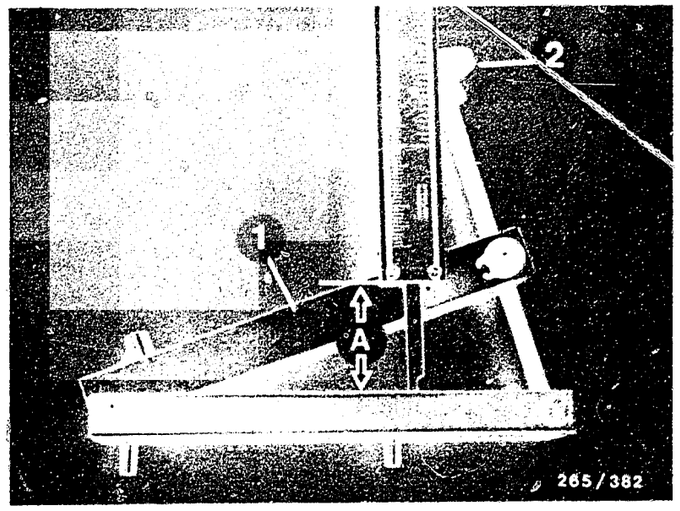


1 = Acceleration sensor
2 = Chock
3 = Shear-head screw, front
4 = Shear-head screw, rear
Arrow = Forward direction of travel

1 = Feeler gauge
2 = Adjusting screw



V

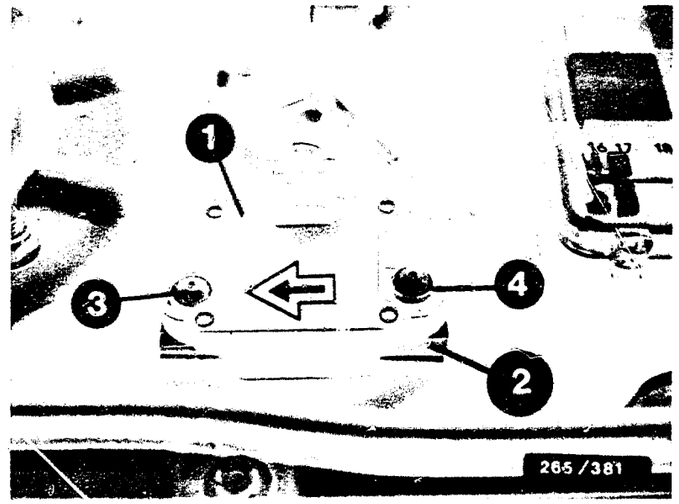
Actual value greater than maximum set value: position support beneath rear mounting point.

Compensate for difference determined with wench and/or plain washer. Chock corresponds to 4,9...5,3 mm.

Check switching point once again with support positioned.

Position acceleration sensor correctly on to support and secure with new shear-head screws.
Screw off the head of the shear-head screw.
Tightening torque: 6...8 Nm.

A maximum of one wedge and 3 plain washers (each of 1 mm) is permissible. If necessary, align mounting support of the bodywork.



1 = Acceleration sensor
2 = Chock
3 = Shear-head screw, front
4 = Shear-head screw, rear
Arrow = Forward direction of travel

TEST STEP 6 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Operation:

Valve-relay operation term. 27

* Operation:	Position:
Program switch	5
Push-button	–

* Operation in vehicle:
  Ignition on.

* Test specification (indication):
  LED 3 (upper illustration) lights up.

N

Trouble-shooting:

Switch off ignition.

No reading:

* Test following leads for open circuit and contact resistance:

  From X1/term. 27 to hydraulic-modulator plug term. 2 .

  From X1/term. 32 to hydraulic-modulator plug term. 4 .

  From hydraulic modulator term. 4 to valve relay term.30.

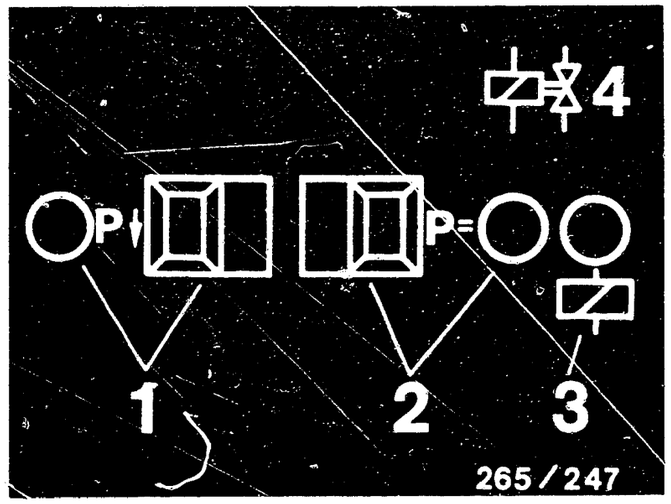
  From hydraulic modulator term. 2 to valve relay term.85.

  From hydraulic modulator term. 6 to valve relay term.87.

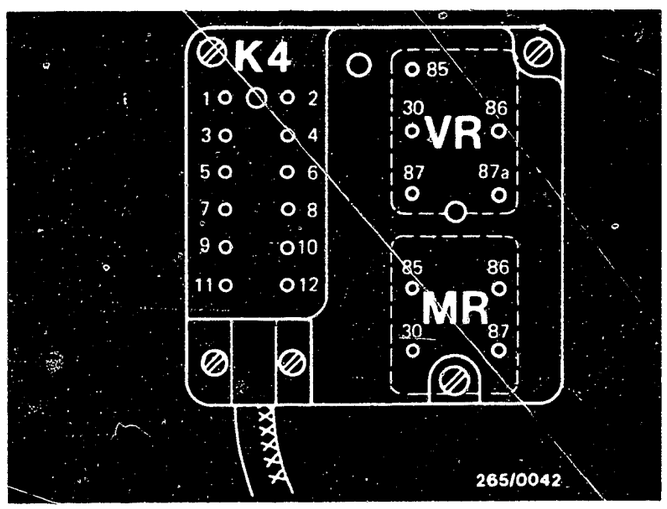
  From hydraulic-modulator plug term. 6 to B+ .

  From valve relay term. 86 to motor relay term. 86.

* Valve relay defective:
  exchange.



Pluggable printed-board assembly of hydraulic modulator, position of terminals: VR = Valve relay
MR = Motor relay
K4 = Hydraulic-modulator plug



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Component/Operation:

Check operation and for mix-up of solenoid-operated valves in hydraulic modulator.

Pressure-holding function
point 1 to 3 and
Pressure-release function
point 4 to 5.

Note:

Check each wheel separately in turn, observe operating sequence.

* Operation:	Position:
Program switch	5

* Operation in vehicle and at tester:

Chock up vehicle. The wheel being tested must be freely turnable by hand.
Ignition on.
Set switch 1 (upper ill.) for wheel selection to wheel to be tested.

1. (Lower illustration)
Push-button P = keep pressed
Test specification:
LED P = lights up.

N>

1. LED P (lower illustration) does not light up:

* Battery insufficiently charged.

* Repeat test with engine running.

* Valve relay (make contact) defective.

* Ground terminals must be bare and firmly connected.

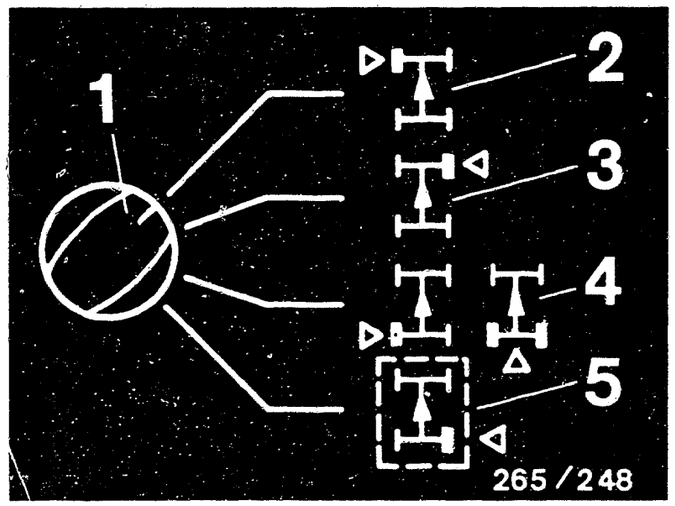
Test following leads for voltage drop and open circuit.

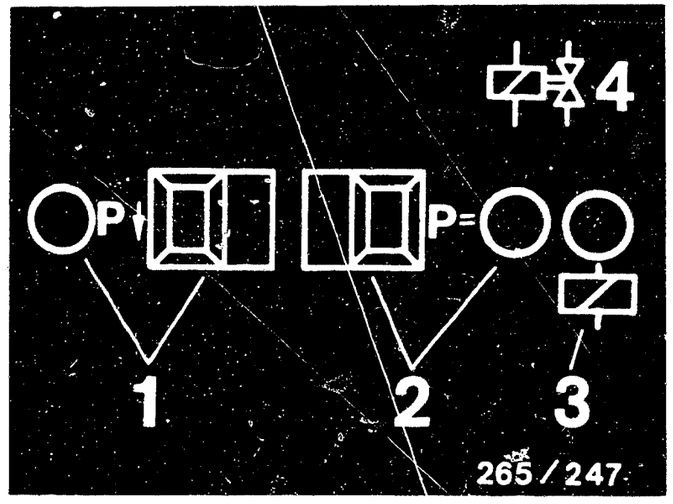
* Lead from controller plug X1/term. 10 to ground.

* Lead from controller plug X1/term. 34 to ground.

* Positive lead from controller plug X1/term. 1 to overvoltage-protection relay term. 30a.

* Lead from valve relay term. 87 to B+.





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2. Constantly press brake pedal.

   Test specification:
   Wheel turnable by hand.

3. Release push-button P=.
   (upper illustration)

   Test specification:
   LED P= goes out,
   wheel locks.

Pressure reduction:

4. Press push-button P arrow
   (upper illustration)

   Test specification:
   LED P arrow lights up.
   Wheel turnable by hand.

5. Release push-button P arrow
   (upper illustration)

   Test specification:
   LED P arrow goes out,
   wheel locks.

6. Release brake pedal.

Continued D09

2. Wheel locks or wheel
   cannot be turned:

* Hydraulic brake lines at hydraulic modulator (lower illustration) mixed up.

* Solenoid-operated valves correctly electrically connected?

  Wheel, front left:
  from controller plug
  X1/term. 2 to hydraulic-
  modulator plug term. 1

  Wheel, front right:
  from controller plug
  X1/term. 35 to hydraulic-
  modulator plug Y1/term. 3

  Rear axle:
  From controller plug
  X1/term. 18 to hydraulic
  modulator plug term. 5

* Test ground strap of pump for firm seating.
  Terminal connections must be bare.

* Test positive connection of pump for voltage drop and firm seating.
  Connection must be bare and firmly tightened.

* Hydraulic modulator defective.

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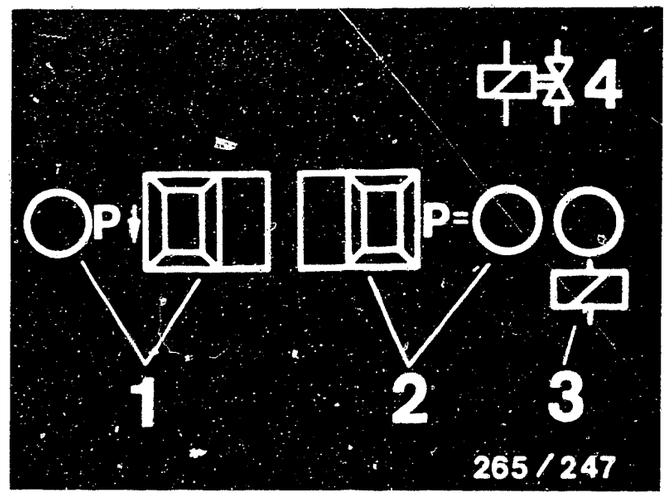
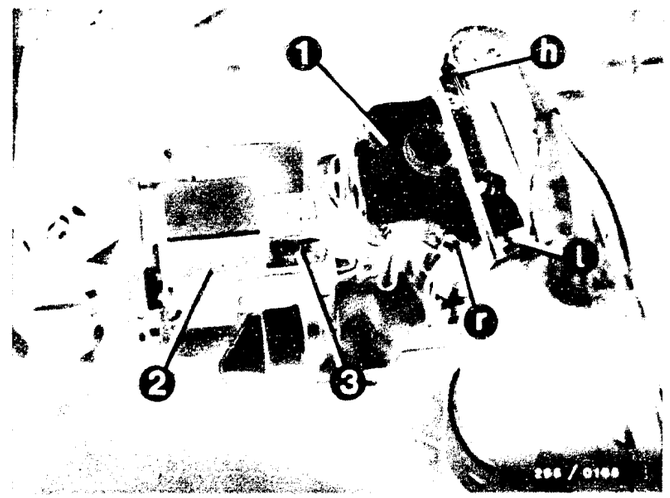


1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay



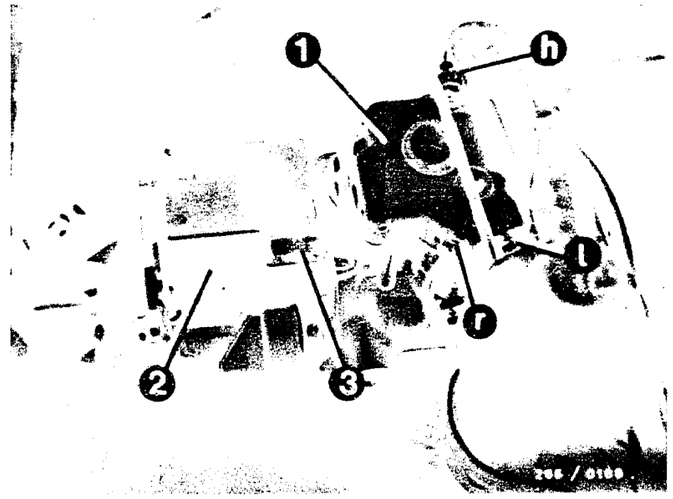
Removing the hydraulic modulator:

* For reasons of safety, the hydraulic modulator must not be repaired, but be exchanged as a complete unit.

  Excepted from this are the motor and valve relays (upper illustration). Both relays may be exchanged.

* Apart from the brake-line connections, no screws on the hydraulic modulator must be loosened. In particular, the hexagon-socket-head cap screws and Torx screws must under no circumstances be loosened (upper illustration). Once they are loosened, it is impossible to make the brake circuits leak-free ever again. D A N G E R O F F A T A L A C C I D E N T !

* Check the hydraulic modulator and brake-line connections visually for leaks. If brake fluid is escaping, the brake-line connections must be tightened (see brief instructions) or replaced, and the hydraulic modulator exchanged.



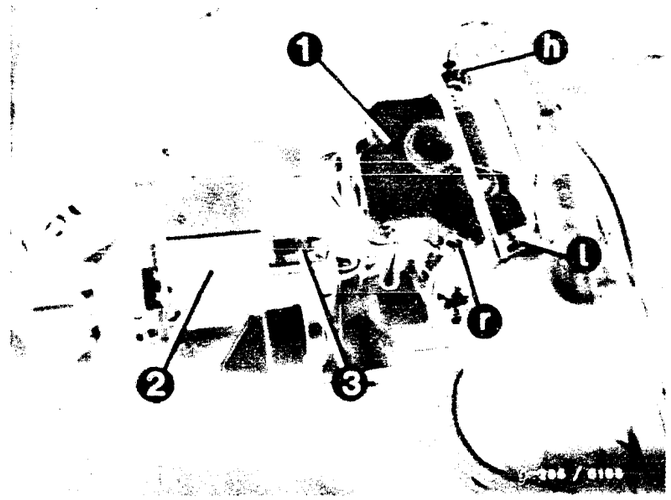
1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

Continued on next picture page

Located at the base of the hydraulic modulator is a ventilation bore to the pump plunger. It is possible for a small amount of brake fluid to escape at this location. A complaint in this regard is justified only if a pool of brake fluid forms beneath the hydraulic modulator after the brake pedal is actuated several times.

* When removing and installing the brake linings, make sure that the lines are marked with the corresponding marking on the hydraulic modulator and re-connected correctly assigned (e.g. "1" from the hydraulic modulator must be connected to the front left wheel-brake cylinder).

* Markings on hydraulic modulator (see illustration):
  - 1 = Connection for front left brake line (wheel-brake cylinder)
  - r = Connection for front right brake line (wheel-brake cylinder)
  - h = Connection for brake line of rear axle
  - V = Front-axle brake circuit from brake master cylinder
  - H = Rear-axle brake circuit from brake master cylinder



1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

Continued on next picture page

* Use only the specified box wrench for loosening and tightening the brake lines.

* Mark the brake lines and loosen them from the hydraulic modulator.

* Catch the brake fluid and do not allow it to come into contact with skin, clothing or paintwork!

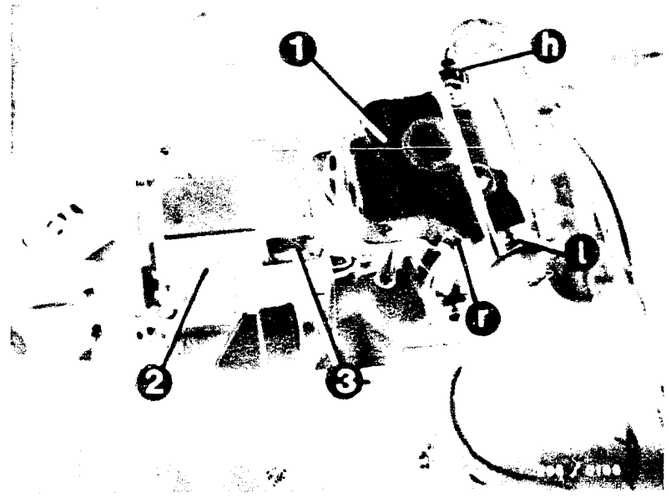
* Immediately seal off the brake lines and connections with dummy plugs.

* Disconnect ground cable from the pump motor.

* Loosen fastening screws and remove cover.

* Loosen clip and remove the plug.

* Loosen hexagon nuts from bracket and remove hydraulic modulator.



1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

Continued on next picture page

Installing

* Insert hydraulic modulator into the bracket and tighten with the hexagon nuts.

* Connect ground cable to pump motor.
  Connect 12-pin plug and secure with the clip.

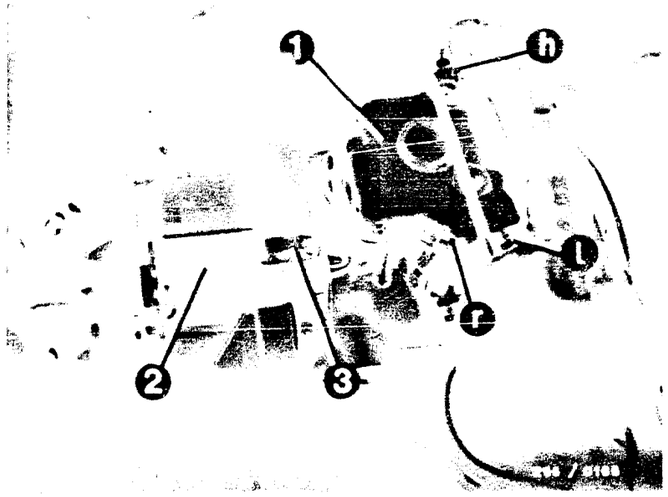
* Secure cover with the screw on the hydraulic modulator.

* Connect brake lines to the hydraulic modulator in accordance with the markings.

* Observe tightening torques for brake-line connections at the hydraulic modulator.

* Bleed the brake system of air and test for leaks.

* Check the ABS completely with the tester.



1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

TEST STEP 7 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component/Operation:

Checking the wheel-speed sensors for operation and mix-up.

Note:
Check each wheel separately in turn. The rear axle can be checked at either the left or right wheel.

* Operation:	Position:
Program switch	6

* Operation in vehicle and tester:

Chock up vehicle.
Ignition on.
The wheel to be tested must be freely turnable by hand. When testing the driven axle, the wheel not being tested must be locked.

Set the switch for wheel selection to the wheel to be tested (upper illustration).

Turn the wheel by hand until LED 2 above the instrument lights up without flickering. (Speed approx. 1 revolution per second).

N

Trouble-shooting:

* 1. LED (lower illustration) does not light up.

* Driven speed of wheel too low or too high.

* Ring gear with incorrect number of teeth or ring gear missing or loose.

* Number of teeth:
front axle: 48 teeth
rear axle : 48 teeth

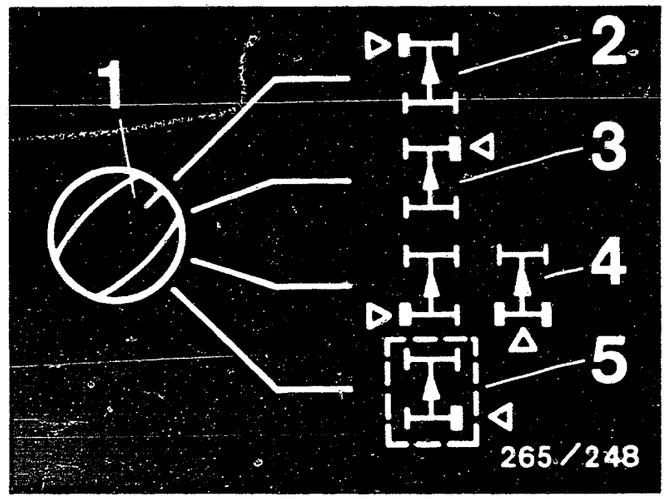
* Loose contact in wheel-speed-sensor lead.

2. LEDs and instrument indicator light up in incorrect switch position:

* Plug-in connections of wheel-speed sensors mixed up.

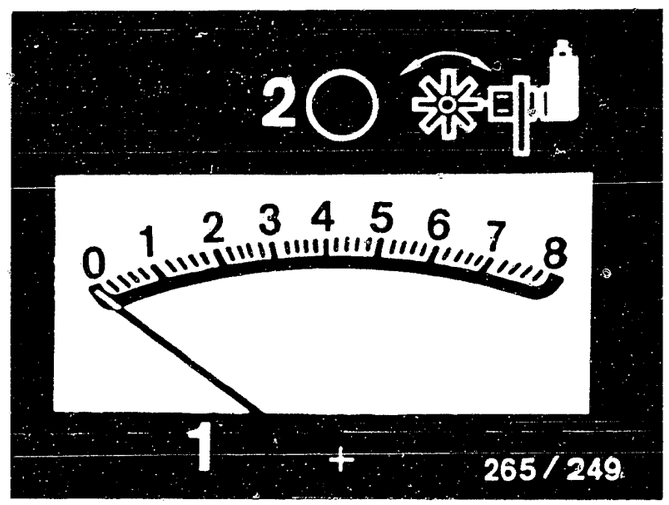
* Leads at plug X1 incorrectly connected.

* Check terminal assignment according to terminal diagram.



1 = Wheel selector switch
2 = Wheel, front left
3 = Wheel, front right
4 = Wheel, rear left or rear axle
5 = Wheel, rear right

1 = Instrument
2 = LED for wheel speed



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Then read off reading at instrument.

Test specification (reading).

* Smallest reading = larger 1,6 divisions.

* Permissible fluctuation max. 25 % of greatest reading.

The test with the tester is complete.
Conduct the following test steps without tester.

Continued D19

Ignition off.

3. No instrument reading:
* Test wheel-speed sensor for open circuit. Pull apart plug-in connection and measure the winding resistance using ohmmeter:

  TEST SPECIFICATION:
  Front axle:
  0.6...1.6 k Ω
  Rear axle :
  0.6...1.6 k Ω

Test following wheel-speed-sensor leads for open circuit.

* Wheel, front left: from controller plug X1/term. 22 and term. 4 to plug-in connection X 2.

* Wheel, front right: from controller plug X1/term. 11 and term. 21 to plug-in connection X 3.

* Wheel, rear left: from controller plug X1/term. 8 and term. 9 to plug-in connection X 4.

* Wheel, rear right: from controller plug X1/term. 24 and term. 26 to plug-in connection X 5.

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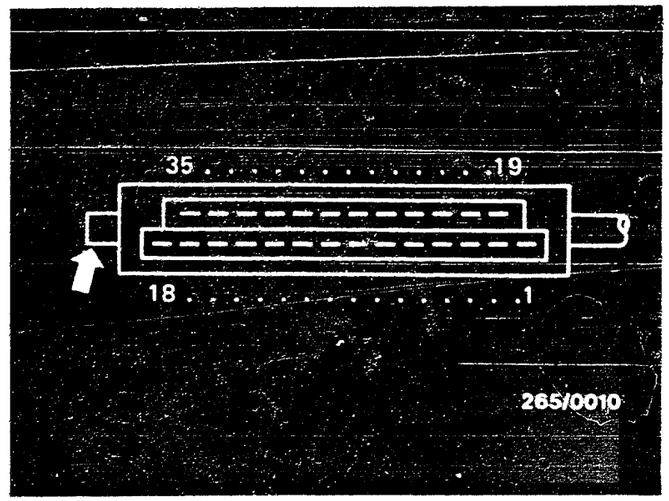


Plan view of controller plug X1 (35-pin) with terminal numbers.
Arrow = Lug with mechanical encoding

4.Instrument reading smaller than or near to 1,6:

* Air gap between wheel-speed sensor and ring gear too wide.

* Nominal dimension
  Front axle:0,3...1,3 mm
  Rear axle :0,3...1,3 mm

* Ring gear defective or loose or with incorrect number of teeth.

  Front axle:48 teeth

  Rear axle :48 teeth

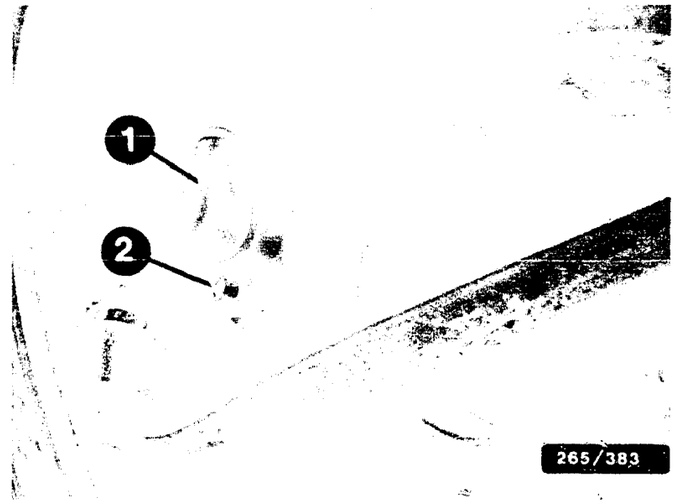
* Wheel-speed sensor defective: exchange.

5.Fluctuation too great:

* Wheel-bearing clearance too large.

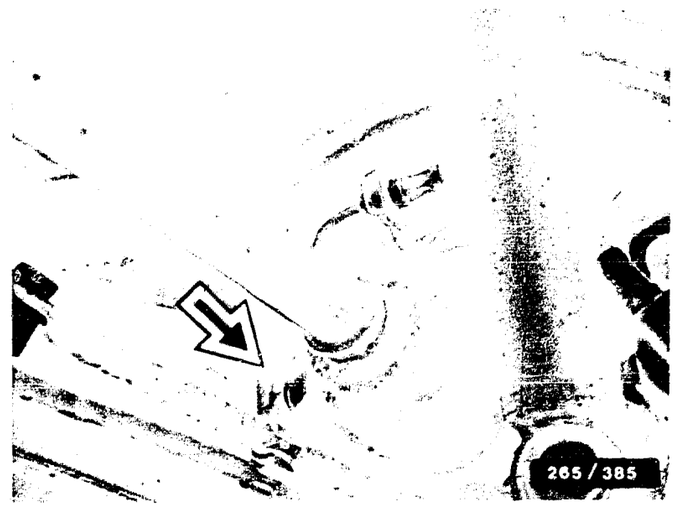
* Ring gear defective.

* Ring gear out-of-center.



1 = Wheel-speed sensor
Front axle, right
2 = Fastening screw

Arriw = Wheel-speed sensor
Rear axle, right



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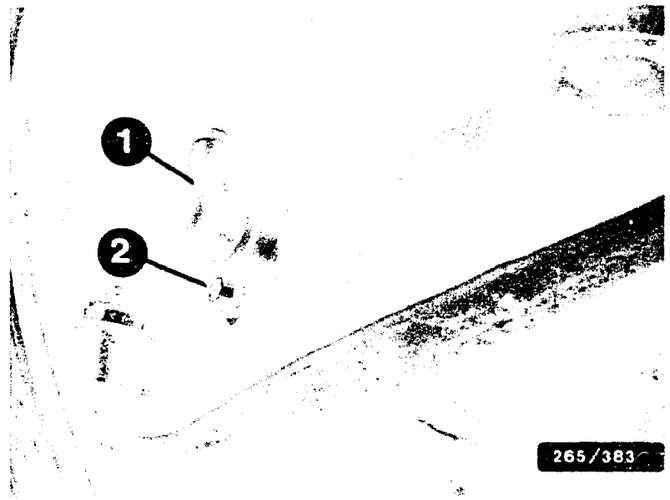
Removing wheel-speed sensor:

* The plug-in connections for the front axle are located in the engine compartment in front of the left-hand spring-strut dome and on the right-hand cross-member beneath the fluid reservior. The plug-in connections for the rear axle are behind the lead-through in the floor panel.

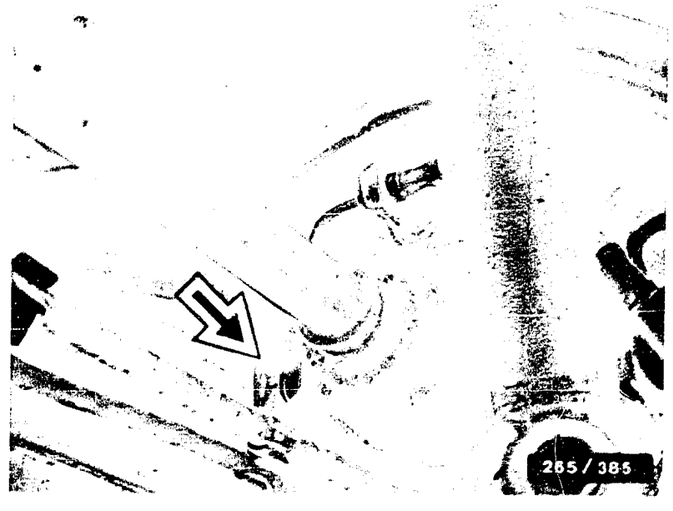
* Pull apart plug-in connections.

* Loosen fastening screw for wheel-speed sensor and carefully remove wheel-speed sensor.
  Do not use force.



1 = Wheel-speed sensor
Front axle, right
2 = Fastening screw

Arriw = Wheel-speed sensor
Rear axle, right



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Installing wheel-speed sensor

* Remove new wheel-speed sensor from protective sleeve only immediately before assembly.

* Slightly grease wheel-speed-sensor housing with lubricant Molykote Longterm 2.

* Make sure that there are no metallic foreign bodies on the permanent-magnet edge.

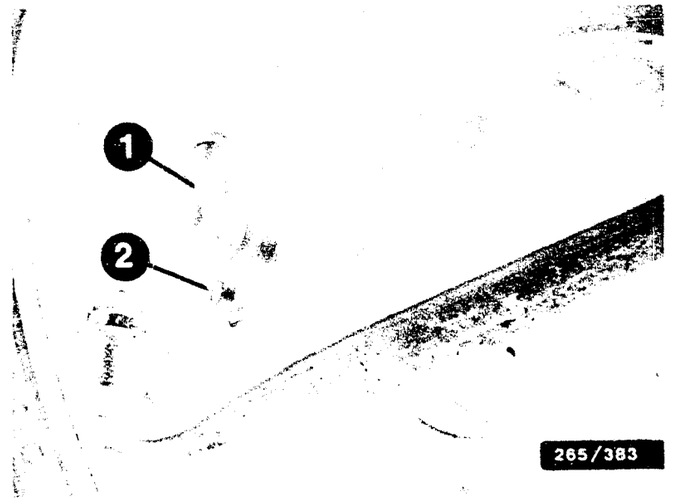
* Push wheel-speed sensor carefully into locating bore as far as it will go. (For air gap, see brief instructions)
  Do not hit with a hammer or similar tool!

* Use new micro-encapsulated fastening screws. Tighten fastening screws to at least (see brief instructions) Nm.

* Secure lead once again to the specified locations.

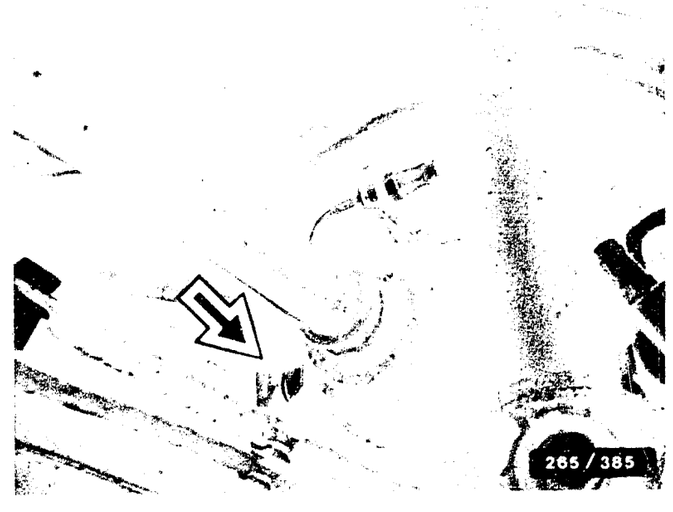
* Connect wheel-speed sensor to ABS wiring harness and clip plug-in connection into bracket.

* After repairing, test with the LED tester.



1 = Wheel-speed sensor
Front axle, right
2 = Fastening screw

Arriw = Wheel-speed sensor
Rear axle, right



LEERLAUFDREHZAHLANHEBUNG PRÜFEN (1)

1. Throttle-valve actuator (if present):
When the ignition is switched on or off, the idle stop of the actuator must be extended.

Idle stop extended?

N> Throttle-valve actuator defective.

Y

Run engine at idle speed:
Idle stop of actuator must retract.

Stop retracted?

N> Stop not retracted, therefore, excessively fast idle speed.

Test vacuum actuation of the actuator:
test hoses for leakages and correct assignment.

Y

Disconnect hose from throttle-valve actuator and apply vacuum to actuator via vacuum pump:

Stop must retract.

Does stop retract?

N> Throttle-valve actuator defective.

Y

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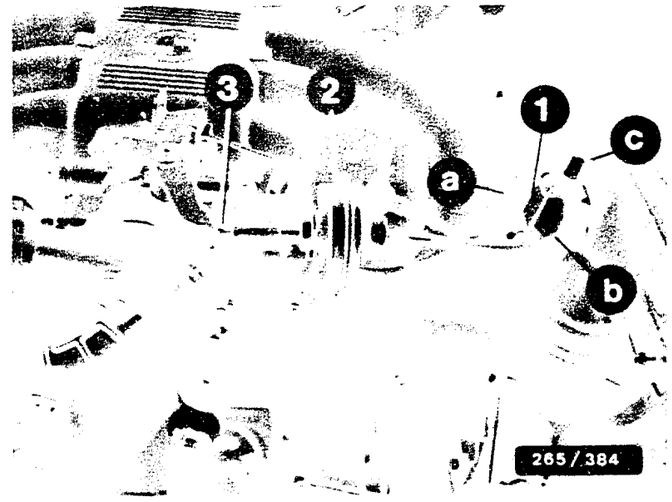

1 = Solenoid-operated valve
a = Vacuum line to intake manifold
b = Vacuum line to actuator
c = Ventilation to atmosphere
2 = Throttle-valve actuator
3 = Adjusting screw

LEERLAUFDREHZAHLANHEBUNG PRÜFEN (2)

2. Solenoid-operated valve (if present):
Disconnect plug from solenoid-operated valve and apply battery voltage to solenoid-operated valve.

With the engine running, the actuator must extend and the idle speed increase.

Does actuator extend?

N> Solenoid-operated valve defective.

Y

Test leads to solenoid-operated valve:

Ignition off.
Test leads from solenoid-operated valve to controller plug term. 3 and to ground for open circuit and short circuit.

Leads O.K.?

N> Ensure leads are in working order.

Y

Adjusting idle-speed increase:

Disconnect hose from actuator.
With the engine running, idle speed increases to
2400 + 100 min $^{-}$.

Increased idle speed O.K.?

N> Adjust increased idle at the adjusting screw of the throttle-valve actuator.

Y

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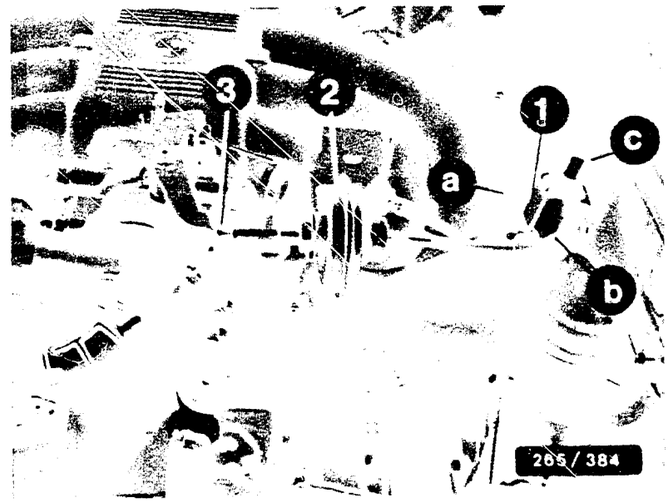
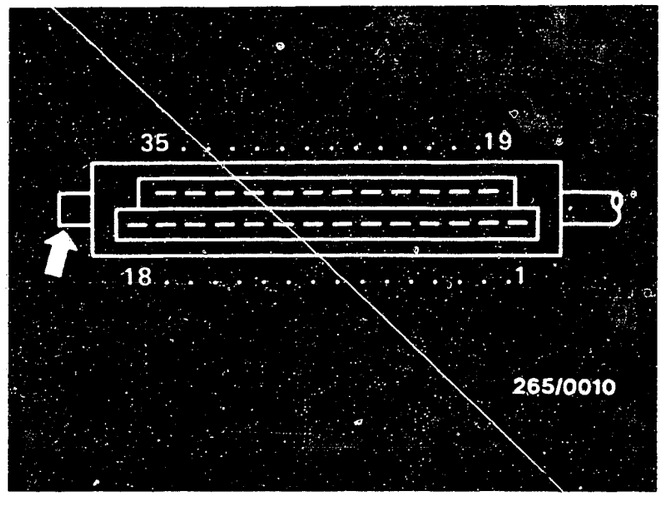


1 = Solenoid-operated valve
a = Vacuum line to intake manifold
b = Vacuum line to actuator
c = Ventilation to atmosphere
2 = Throttle-valve actuator
3 = Adjusting screw

Plan view of controller plug X1 (35-pin) with terminal numbers.
Arrow = Lug with mechanical encoding



TESTING ENGINE-DRAG-TORQUE CONTROL (1)

Engine-drag-torque control (MSR):

As of approx. 1.87 with the introduction of the Motronic M1.1 (55-pin plug), the throttle-valve actuator and solenoid-operated valve are no longer fitted. The engine speed and ignition are now influenced via the Motronic, in order to reduce the engine-drag torque.

Testing operation of the MSR:

Ignition off.
Disconnect ABS controller and throttle-valve-switch plug.
Run engine at approx. 3000 min^{-1} without load.
Jump term. 2 and term. 18 in the throttle-valve-switch plug with suitable lead (this simulates closed idle contact).
Engine "hunts".
Subsequently jump term. 1(B+) and term. 3 in the controller plug.

Set value:
Engine speed increases again to approx. 3000 min^{-1}, i.e. end of overrun cut-off.

Is set value O.K.?

N>

Test following leads:

From ABS controller plug term. 3 to Motronic control-unit plug term. 50 via engine plug term. 17.
From throttle-valve-switch plug term. 2 and term. 18 to Motronic control-unit plug term. 52 and ground.

Motronic control unit defective.

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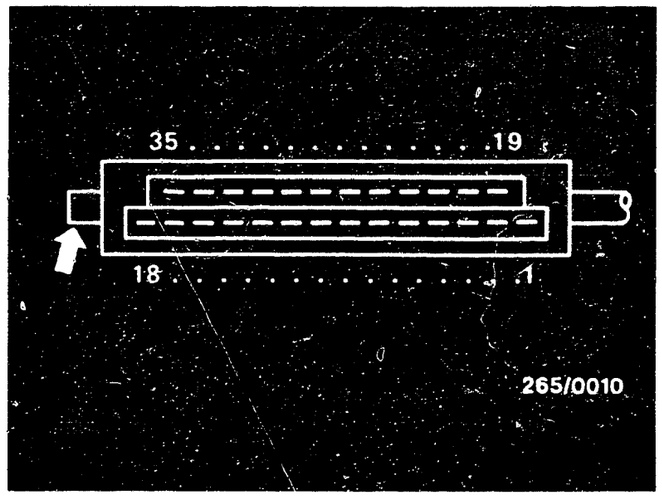
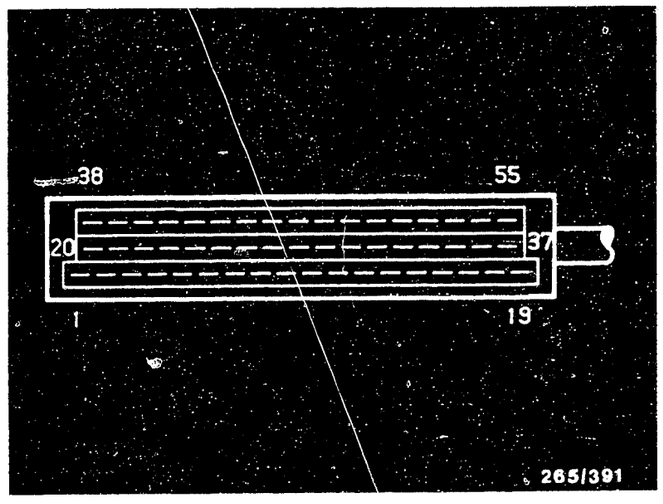


Plan view of controller plug X1 (35-pin) with terminal numbers.
Arrow = Lug with mechanical encoding

Plan view of 55-pin control-unit plug



TESTING CLUTCH SWITCH (1)

Clutch switch:

Ignition off.
Disconnect controller plug.
Connect voltmeter to term. 33(+) and ground.

Switch on ignition and actuate brake pedal:
Set value:
voltage greater than 10 V.

Depress clutch:
Set value: voltage 0 V.

Set values O.K.?

N> *Test clutch switch and leads.

*Adjust clutch switch.

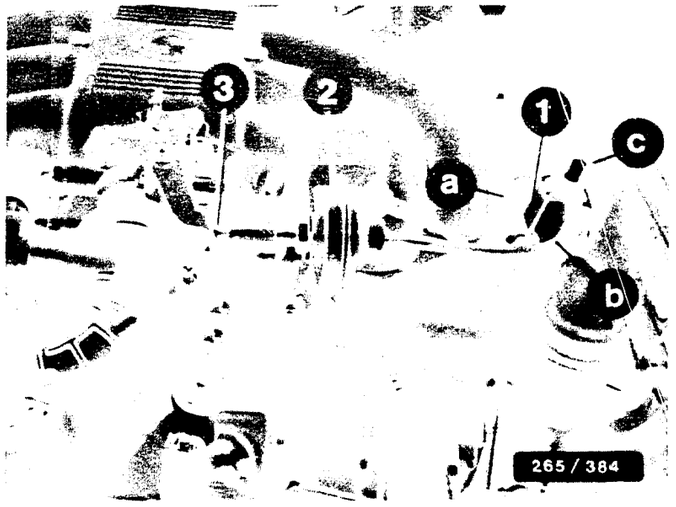
Y

If no fault can be found with the LED tester, check for loose contacts or rubbed locations in the leads, or exchange controller.

Take the vehicle for a test drive as a final test.

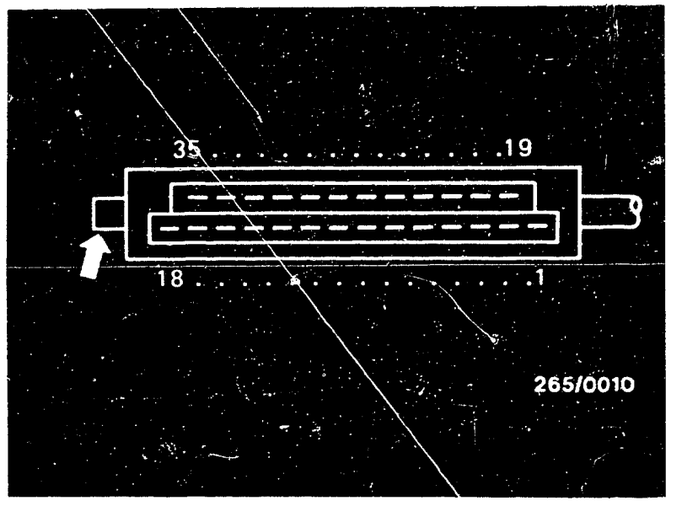
When the engine is running, the warning lamp must go out.

Drive for at least 20 seconds at a speed exceeding 30 km/h and a speed exceeding 50 km/h for at least 3 seconds.
Warning lamp must not light up.



1 = Solenoid-operated valve
a = Vacuum line to intake manifold
b = Vacuum line to actuator
c = Ventilation to atmosphere
2 = Throttle-valve actuator
3 = Adjusting screw

Plan view of controller plug X1 (35-pin) with terminal numbers.
Arrow = Lug with mechanical encoding



T E C H N I C A L B U L L E T I N

13....39
VDT-I-265/102 En
1.1986

REPAIR PROHIBITION /
MAXIMUM ALLOWABLE STORAGE TIME
FOR ABS HYDRAULIC MODULATORS

Replaces edition of 7.1984

1. Repair prohibition

ABS for passenger vehicles is a safety system.
Unauthorized tampering with ABS components brings with it the danger of impairment of the proper functioning of the ABS system.

For reasons of safety, therefore, the
hydraulic modulator may under no circum-
stances be repaired, but instead must be
exchanged as a complete unit.

Only the engine and valve relays may be exchanged.
No other screws or plugs may be loosened or removed.

2. Maximum allowable storage time

The maximum allowable storage time for hydraulic modulators is 5 years from the date of manufacture (FD) specified on the product.

This requires that the following storage conditions be fulfilled:
- Hydraulic modulator filled with brake fluid (supplied in filled condition).
- Vertical/upright position (hood on top).
- Ambient temperature between -20°C and +50°C.
- Dry storage.

After 5 years storage time, all rubber and plastic parts must be replaced and the hydraulic modulator must be subjected to a functional test.

The replacement of rubber and plastic parts and the functional test can be carried out only at the place of manufacture. After testing, the hydraulic modulators are marked with |L| and a new date of manufacture (FD).

Service workshops in the Federal Republic of Germany should send the hydraulic modulators to:
Robert Bosch GmbH Abt. K1/VAK 2,
Robert-Bosch-Straße, 7141 Schwieberdingen.
Service workshops in other countries are requested to send the hydraulic modulators to:
Robert Bosch GmbH, KH/LAV 2 - Auspackraum,
z.W. an K1/VAK 2, Auf der Breit 4,
D-7500 Karlsruhe 41
West Germany.

The hydraulic modulators should be sent to us pre-paid.
Please refer to this Technical Bulletin on the enclosed delivery ticket.
A fee is charged for parts replacement and functional testing.

Responsible:
ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)
Please address questions and comments concerning the contents to our authorized representative in your country.

TECHNICAL BULLETIN

Pass. car brake
VDT-I-PB 110 En
06.1986

BRAKE DYNAMOMETER
Brake test on vehicles with viscous lock (all-wheel drive) e.g. BMW 325 iX, VW Golf Syncro, VW Type 2 Syncro (Transporter)

Brake test:

Test brakes on a single-axle brake dynamometer for no long than 60 seconds.

20 seconds each for – front axle
– rear axle
– hand brake.

Since the viscous locks must cool down, the brake test may be repeated only after a period of 30 minutes has elapsed.

CAUTION :
If this cooling-down period is not observed, there is a danger of a total breakdown of the viscous coupling – Do not switch to individual-wheel mode.

Observe the specifications of the vehicle manufacturer under all circumstances!

Explanation:

During the brake test, the wheels of one axle are at standstill.
The speed difference between 0 and max. 7.5 km/h is balanced by the viscous lock of the differential.

If the test duration (60 seconds) or the test speed (7.5 km/h) is exceeded, the silicone fluid escapes from the viscous coupling owing to the expansion it undergoes.

Note:

Every vehicle with all-wheel drive requires individual treatment.

For this reason, the operating instructions appropriate for the vehicle must be read before every brake test.

Technical Information:

Test speed	BSA 200	– 5 km/h
	BPS 100 S 90	– 5 km/h

Switching to individual-wheel mode possible with BSA 200.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

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For production reasons:
continued on the following
coordinate.

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IMPRESSUM

Automotive Equipment - After-Sales Service
Department for Technical Publications KH/VDT
Postfach 50, D-7000 Stuttgart 1.
Published by: After-Sales Service
Department for Training and Technology
(KH/VSK). Press date: 11.1987.
Please direct questions and comments
concerning the contents to our authorized
representative in your country.

Microfilmed in the Federal Republic of Germany. Microphotographié en République Fédérale d'Allemagne.